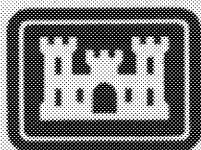
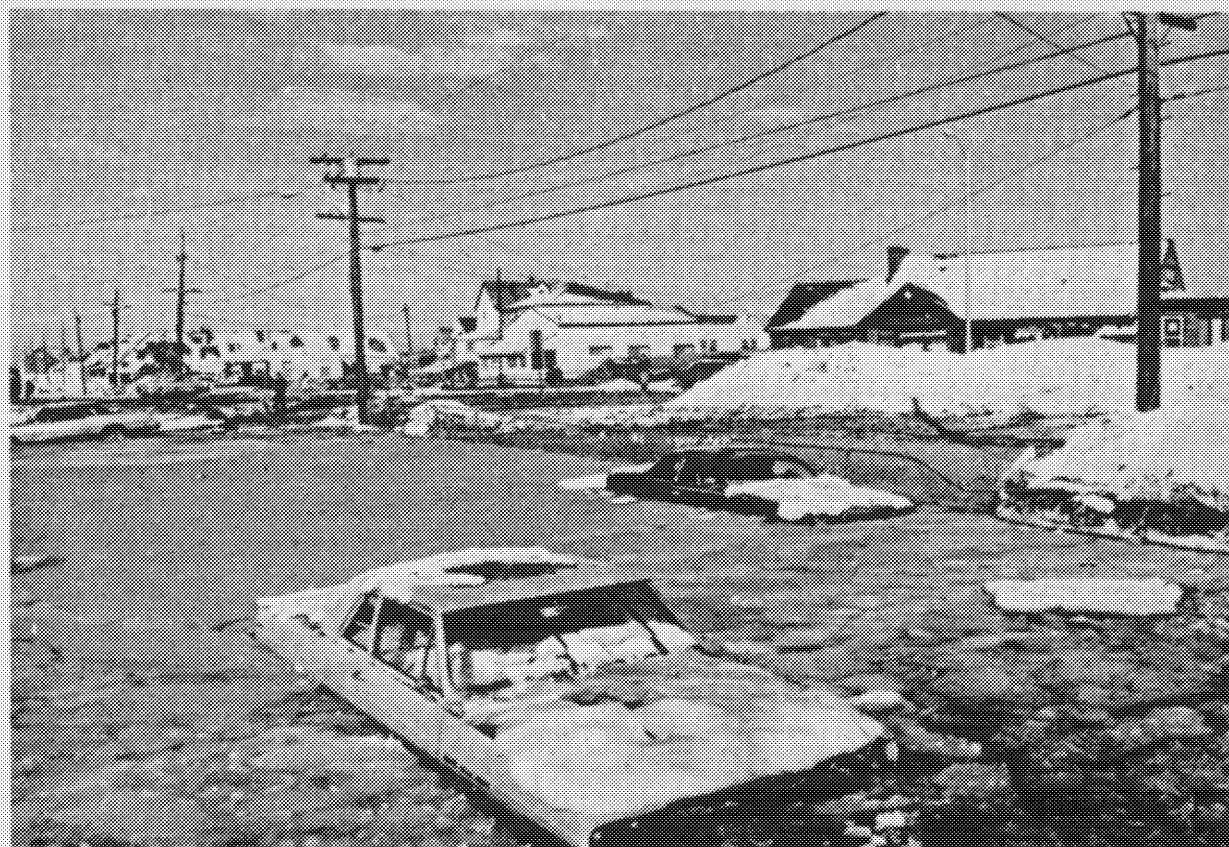


WATER RESOURCES INVESTIGATION
RECONNAISSANCE REPORT

REVERE, MASSACHUSETTS COASTAL FLOOD PROTECTION STUDY



**US Army Corps
of Engineers**
New England Division

JUNE 1981

ACKNOWLEDGEMENTS

The New England Division (NED), US Army Corps of Engineers prepared this report under the overall direction of Colonel C. E. Edgar, III, Division Engineer and Joseph L. Ignazio, Chief of the Planning Division. The Basin Management Branch (BMB) of the Planning Division has overall responsibility for the study under the supervision of its Chief, Lawrence J. Bergen. Study management is provided by the Comprehensive River Basin Section (CRBS) headed by Arthur F. Doyle of BMB.

Study team members include:

Joseph A. Bocchino - Project Manager: Roughan's Point

Robert G. Hunt - Project Manager: Revere Beach, Point of Pines and Oak Island

John E. Kennedy - Nonstructural Analyses

Diana L. Platt - Social Assessment

Lt. Harry Morgan - Base Conditions

Earl O. Perkins - Damage Sampling

Stephen M. McMullin - Economic Analyses

Charles B. Freeman - Environmental Assessment

Edward J. Fallon - Real Estate Studies

Frederick G. Feely - Real Estate Conveyancing

James M. Aiken - Structural Design

Anthony R. Riccio - Coastal Engineering

Eugene Brickman - Geotechnical Engineering

James T. Blair - Foundation Studies

Charles J. Wener - Hydraulic Analyses

Renzo P. Michielutti - Hydrologic Investigations

This reconnaissance report was prepared for publication by NED's Word Processing Center under the supervision of Patricia A. Wysocki, assisted by Marianne Conway.

Thanks are extended to the city of Revere's Department of Planning and Community Development. Their cooperation, coordinated by Robert Krinsky, helped significantly with this report. Additional thanks are in order to the Metropolitan District Commission (MDC), the Division of Waterways and the Office of Coastal Zone Management (CZM) of the Commonwealth of Massachusetts for their continuing cooperation in NED activities including this study.

REVERE, MASSACHUSETTS
COASTAL FLOOD PROTECTION STUDY
RECONNAISSANCE REPORT

TABLE OF CONTENTS

<u>ITEM</u>	<u>PAGE</u>
SECTION I	
<u>INTRODUCTION</u>	
A. STUDY AUTHORITY	1
B. PURPOSE AND SCOPE	1
C. OTHER STUDIES	2
D. THE REPORT AND STUDY PROCESS	3
SECTION II	
<u>PROBLEM IDENTIFICATION</u>	
A. NATIONAL OBJECTIVES	6
B. COMMONWEALTH OBJECTIVES	7
C. EXISTING CONDITION	7
(1) Flood Prone Areas	7
(2) Climatology	8
(3) Storms	9
(4) Topography and Geology	15
(5) Fish and Wildlife	15
(6) Social Environment	15
(7) Cultural and Natural Resources	17
(8) Land Use	18
D. PROBLEMS, NEEDS AND OPPORTUNITIES	19
(1) Roughan's Point	20
(2) Revere Beach	20
(3) Point of Pines	20
(4) Oak Island	20

TABLE OF CONTENTS (Cont'd)

<u>ITEM</u>	<u>PAGE</u>
E. THE WITHOUT CONDITION	21
(1) Development	21
(2) Flood Threat	22
F. PLANNING CONSTRAINTS	23
G. STATEMENTS OF PROBLEMS AND OPPORTUNITIES	23

SECTION III

PRELIMINARY PLAN FORMULATION

A. PLANS OF OTHERS	25
(1) State	25
(2) Other	25
B. INSTITUTIONAL ARRANGEMENTS	25
(1) Analysis	26
C. STUDY MANAGEMENT	27
(1) Responsibility	27
(2) Coordination	27
D. DATA COLLECTION AND BASIC STUDIES	27
(1) Socioeconomic	27
(2) Institutional	28
E. PUBLIC INVOLVEMENT	28
(1) General	28
(2) Objectives	28
(3) Interactions	29
(4) Schedule	31
F. MAJOR WORK ITEMS	31
(1) Problem Identification	31
(2) Plan Formulation, Impact Assessment and Evaluation	31
G. FINAL REPORT	32

TABLE OF CONTENTS (Cont'd)

<u>ITEM</u>		<u>PAGE</u>
SECTION IV		
<u>PRELIMINARY INVESTIGATIONS</u>		
A.	MANAGEMENT MEASURES	33
B.	ROUGHAN'S POINT	35
C.	REVERE BEACH	36
D.	POINT OF PINES	37
E.	OAK ISLAND	37
SECTION V		
<u>CONCLUSIONS AND RECOMMENDATIONS</u>		
A.	CONCLUSIONS	39
B.	RECOMMENDATIONS	39
SECTION VI		
<u>APPENDICES</u>		
A.	GREAT BLIZZARD NEWSCLIP	A-1
B.	FISH AND WILDLIFE RESOURCES	B-1
C.	CORRESPONDENCE	C-1
D.	EXISTING INSTITUTIONS	
	A. FEDERAL	D-1
	B. INTERSTATE	D-2
	C. COMMONWEALTH OF MASSACHUSETTS	D-2
	D. REGIONAL	D-4

TABLE OF CONTENTS (Cont'd)

<u>NUMBER</u>		<u>PAGE</u>
	<u>TABLES</u>	
1	AVERAGE DAILY TEMPERATURE	10
2	MONTHLY EXTREMES IN TEMPERATURE	11
3	PRECIPITATION	12
4	SNOWFALL	13
5	PAST POPULATION	16
6	PROJECTED POPULATION	17
7	ANNUAL FLOOD DAMAGES	21
8	FLOOD PROTECTION PLANS TO BE CONSIDERED	34
	<u>PLATES</u>	
1	SAUGUS-PINES WATERSHED	
2	STUDY AREA	
3	STONE BERM - ROUGHAN'S POINT	
4	REVERE BEACH RESTORATION	
5	STONE BERM - POINT OF PINES	
6	SANDFILL - POINT OF PINES	
7	TIDAL GATES AND PUMP STATION - OAK ISLAND AND VICINITY	

SECTION I

INTRODUCTION

SECTION I

INTRODUCTION

An initial study performed under the special continuing authority of Section 205 of the 1948 Flood Control Act, as amended, determined the impact of the February 1978 storm of record and evaluated the extent of damages experienced. During the Section 205 investigation, the study area was separated into four separate zones: (1) Roughan's Point, (2) Revere Beach (3) Point of Pines, and (4) Oak Island and vicinity. That initial investigation determined that no flood control projects in the four zones of Revere could be recommended under the Section 205 authority. All alternatives studied had project first costs that exceeded the Federal limitation of \$3 million (declared disaster areas) allowed by Section 205. However, because of the large amount of damages sustained during the February "Blizzard of 1978" storm, there appeared to be sufficient justification for further study under the Southeastern New England (SENE) authorization.

A. STUDY AUTHORITY

The Water Resources Planning Act of 1965 and a resolution adopted 12 September 1969 by the Committee on Public Works of the United States Senate provided for a study to determine "... the feasibility of providing water resource improvements for flood control, navigation and related purposes in Southeastern New England ... with due consideration for enhancing the economic growth and quality of the environment." The resultant Level B study of the SENE Water and Related Land Resources was completed in 1975 under the direction of the New England River Basins Commission. It identified the critical problems of tidal flooding even before the disastrous record storm of February 1978, and recommended protection emphasizing nonstructural measures wherever possible.

B. PURPOSE AND SCOPE

This reconnaissance report provides a planning and management tool for the development of alternative solutions to flood protection along the Revere, Massachusetts coast, and considers the desirability of implementing recommendations contained in previous reports and/or adopting further measures for reducing the potential for flood loss. Revere citizens have suffered extreme hardships from flooding. This report identifies past and potential flood damage. As the beginning of a three stage planning process, this study determines the problems, needs and opportunities of the study area. Flood plain management policies and existing flood protection are reviewed, and a determination made as to whether Federal participation is warranted. Communication and coordination have been established with the public, at both the governmental and citizen levels. The study area is the coastline of Revere, a city just north of Boston, Massachusetts (see Plate 1).

C. OTHER STUDIES

Within the Saugus-Pines watershed a number of Federal, state, regional and local agencies have engaged in water resources investigations. As significant data exists related to planning in the watershed, extensive use will be made of these studies and reports to avoid duplication of study effort.

The following prior reports have been prepared which address flood problems along Revere Beach and the Saugus and Pines Rivers.

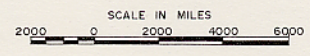
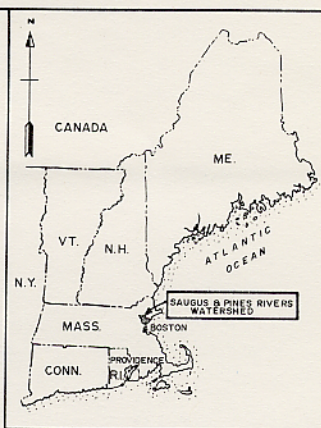
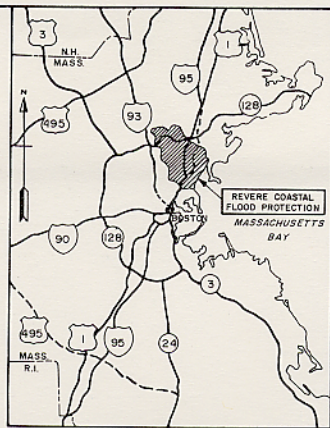
- . The Division Engineer's report on Restoration of Revere Beach was submitted to the Chief of Engineers on 1 June 1949. It was later printed in House Document No. 146, 82nd Congress, 1st Session. The Chief of Engineers recommended that the United States adopt a project for the protection and improvement of the shore of Revere Beach Reservation between Northern Circle (Carey Circle) and a point near Shirley Avenue. The Metropolitan District Commission (MDC) constructed part of the project during 1954.

- . A report on Flood Control for Saugus Branch Brook, Linden Brook and Town Line Brook, dated 15 March 1955, was prepared by a consulting engineer for the MDC. The work proposed for the Saugus River Basin included (1) a reinforced concrete conduit along the upper portion of Town Line Brook and a paved open channel for the lower portion and (2) a reinforced concrete conduit along the lower reach of Linden Brook. Both improvements conveyed flows to a common pumping station with an outlet conduit to the Pines River. The recommended measures have been completed with the exception of the pumping station.

- . A report on a Pines River Detention Basin was prepared by a consulting engineer and submitted to the MDC in January 1965. This report considers the merits of a detention basin near the confluence of the Town Line and Linden Brooks in lieu of the pumping station recommended in the 1955 report. This proposed plan has not been implemented at this time.

- . A Beach Erosion Control Report on Cooperative Study of Revere and Nantasket Beaches, Massachusetts was submitted in March 1968. It was later printed in House Document No. 211, 91st Congress, 2nd Session. The Division Engineer recommended that Revere Beach be widened by placement of suitable sandfill along 13,000 feet of beach fronting the MDC Reservation, thus furnishing a recreational and protective beach averaging 195 feet in width beyond the mean high waterline. Completion of the advanced design phase of the project was deferred during the period from February 1975 to October 1978 because of the lack of non-Federal participation and cooperation. However, October 1978 the MDC agreed to participate in project construction and the study was reactivated. During preconstruction planning, the proposed beach restoration project was found not to warrant Federal participation based on recreational needs.

- . A report entitled Flood Control and Navigation, Saugus and Pines Rivers Basin was submitted by the Division Engineer in June 1970 to the Chief of Engineers. The report focused on flood problems in the 47-square-mile



REVERE COASTAL
FLOOD PROTECTION STUDY
MASSACHUSETTS

**SAUGUS AND PINES RIVERS BASIN
AND ADJACENT COASTAL AREAS**

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

SCALE AS SHOWN

Saugus River Basin (including the Pines River) and along 6.5 miles of tidal shorefront in Revere and Lynn. It was recommended that no structural improvements for the reduction of flood damages be undertaken at that time.

. A master plan for the restoration of the Revere Beach Reservation was prepared for the MDC by consulting engineers and submitted 1 December 1978. Land and Water Conservation funds are being used to develop a linear park system. The plan emphasizes preservation and extension of the beach landscape as a predominantly naturalized seaside parkland. It recommends flooding, storm drainage, and traffic improvements as the backbone of development while also calling attention to the festive highlights of Revere Beach's lively and colorful past. Contemporary facilities will complement restorations of historic structures in order to accommodate beach safety, food, sanitary, bathhouse, amusement, police, and maintenance requirements. Work has already begun and with the realization of these long range improvements, Revere Beach will once again become a major recreational resource for residents of the Boston Metropolitan Area.

. The initial study (summarized earlier) of coastal flood protection problems and needs of Revere performed under Section 205 of the 1948 Flood Control Act, as amended, was submitted by the Division Engineer to the Chief of Engineers in February 1980. This preliminary study provided the impetus for further investigations by the Corps of Engineers.

. A preliminary study of recreational navigation needs in the Pines River area, by the New England Division under Section 107 of the 1960 River and Harbor Act, as amended, resulted in approval of a reconnaissance report by the Chief of Engineers in September 1979. Preparation of a detailed project report is scheduled to be initiated in fiscal year 1982, contingent upon the availability of funds.

. A reconnaissance study of recreational navigation needs at Winthrop Harbor, under Section 107 of the 1960 River and Harbor Act, as amended, is scheduled to be transmitted to local interests for review in July 1981. Appendix C to the Revere coastal flood protection reconnaissance report contains a letter (see page C-4) which discusses navigation and flooding problems at Belle Isle Inlet (the northern arm of Winthrop Harbor), which marks the Revere and Winthrop boundary with East Boston. Both problems will be assessed by the Winthrop Harbor study.

D. THE REPORT AND STUDY PROCESS

This flood protection study will be conducted in three stages: Stage I, which culminates in preparation of the Reconnaissance Report, Stage II - Development of Intermediate Plans; and Stage III - Development of Final Plans.

Planning will consist of executing four functional planning tasks during each of the three stages of plan development. These tasks are problem identification, formulation of alternatives, impact assessment and evaluation.

Iteration of these tasks during any of the planning stages may be necessary and

even desirable in order to reflect an increasing level of effort, detail and refinement. Iteration also provides for the incorporation of additional information to the study as it progresses.

The following paragraphs describe the stages of plan development and the major tasks of the planning process.

(1) Stage I. The purpose of the reconnaissance report, the product of the initial stage of the study effort, is to evaluate the advisability of continuing with more detailed study. Effort at this stage provides a clear indication of the scope of needs, the study area's precise planning objectives, identified planning constraints and the scheduling and management of subsequent planning activities.

(2) Stage II. Development of Intermediate Plans entails a more detailed analysis of the problems as well as the development of a preliminary range of solutions at a general level of detail, assessment and evaluation. The development of alternative plans emphasizes the interaction between problem identification and plan formulation in an attempt to assure public understanding of the basic issues. The final product of this stage forms the basis for determining the scope and direction of planning efforts under Stage III.

(3) Stage III. Development of Final Plans concentrates on developing a select number of more detailed alternative flood protection plans. Extensive public involvement and professional evaluation are required to determine which plans warrant detailed evaluation. Several iterations of the four basic tasks may be needed in order to achieve adequate detailed planning. As a result of Stage III, an array of alternative flood protection plans are formulated that are responsive to study objectives and the problems and concerns of the study area.

SECTION II

PROBLEM IDENTIFICATION

SECTION II

PROBLEM IDENTIFICATION

This section identifies the problems, needs, and opportunities associated with flooding along the Revere coast, the objectives in addressing these, and any planning constraints encountered.

A. NATIONAL OBJECTIVES

Water resources planning undertaken by Federal agencies is directed by the Water Resources Council's Principles and Standards for Planning Water and Related Land Resources. These principles provide the basis for Federal participation with river basin commissions, state agencies and other concerned groups in developing plans for the use of water and related land resources to meet short and long term needs. Plans will be developed in the interest of achieving the two coequal goals of enhancing National Economic Development (NED) and National Environmental Quality (EQ). Economic development is enhanced by increasing the value of the Nation's output of goods and services and by improving national economic efficiency. The quality of the environment is enhanced by the improved management, conservation, preservation, creation or restoration of certain natural and cultural resources and ecological systems.

In addition, Section 73 of the Water Resources Development Act of 1974 mandates:

"(a) In the survey, planning or design by any Federal Agency of any project involving flood protection, consideration shall be given to nonstructural alternatives to prevent or reduce flood damages including, but not limited to, floodproofing of structures; flood plain regulation; acquisition of flood plain lands for recreational, fish and wildlife, and other public purposes; and relocation with a view toward formulating the most economically, socially and environmentally acceptable means of reducing or preventing flood damages."

The Corps seeks plans to reduce flood damages within the study area. Water resources planning conducted by the Corps must develop, through public involvement, plans solving flood problems in conjunction with other urban planning programs (see Table 8).

B. COMMONWEALTH OBJECTIVES

In 1978 the Massachusetts Water Resources Study identified certain state objectives with regard to flooding and wetlands. These objectives were broken down into desired results through preferred means. The following lists the Commonwealth's aims:

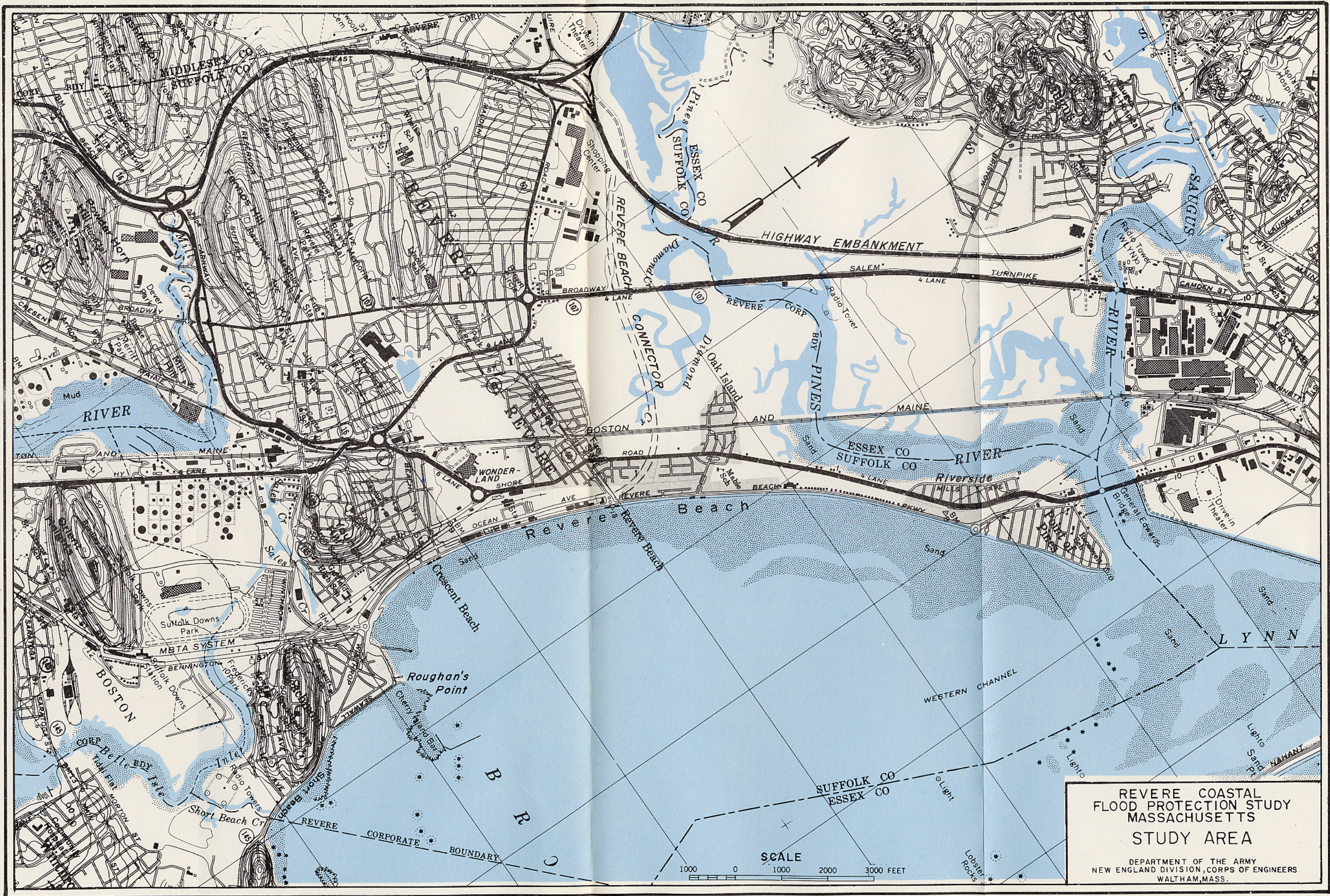
Desire	Preference
• Reduce flood damage to existing properties	Reduction of susceptibility
• Improve economic efficiency from development of flood-free areas	Guide development away from flood-prone areas
• Avoid increased flood damage	Protection of flood storage from loss by development
• Reduce future flood damage	Protect flood-prone areas from development

C. EXISTING CONDITION

The city of Revere is located on the Massachusetts coast about 2 miles northeast of the East Boston section of the city of Boston (see Plate 2). About one-fifth of its area is a salt marsh adjacent to the Pines River estuary, and about one-third of the city, including the marsh area, is below elevation 10 feet, National Geodetic Vertical Datum (NGVD). The study area is the coastal region of Revere. Four sites have been identified as being particularly flood prone. They are Roughan's Point, Revere Beach, Point of Pines, and the Oak Island areas.

The remainder of the city is gently rolling with a few steep hills, the highest elevation being at the reservoir on Fennos Hill at about 192 feet NGVD. Most of the land above 10 feet NGVD is fully developed and, for all practical purposes, any new development could be expected only at the expense of existing uses. The population of the city is about 42,000, and on peak summer days more than 16,000 people visit the 3.5-mile long Revere Beach for recreational purposes.

(1) Flood Prone Areas. Roughan's Point is a low-lying, ocean front area in the Beachmont section of Revere consisting primarily of summer and permanent residences in an 85-acre watershed. Thirty-three acres of this property are subject to flooding on almost a yearly basis. Existing protection consists of a concrete seawall along the easterly shore having a top elevation of about 17 feet NGVD. The northerly facing shoreline is protected only by a stone dike having a top elevation of about 10 to 12 feet NGVD. Flooding is primarily due to wave overtopping and inadequate pumping facilities.



REVERE COASTAL
FLOOD PROTECTION STUDY
MASSACHUSETTS
STUDY AREA

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

Revere Beach extends from Roughan's Point to Point of Pines, but does not include the Oak Island area. This area incorporates the public beach maintained by the MDC. At one time the entire shoreline of this area was lined with commercial establishments including an amusement park, bars, arcades, and fast-food establishments catering to tourists. Some of these establishments remain along the northern portion of the beach, but the majority of the buildings, including the amusement park, have been torn down and the land has been cleared and readied for development. The MDC is developing a linear park system using Land and Water Conservation funds. A concrete seawall at about elevation 16 NGVD extends along the entire length of this area. Flooding results from wave overtopping of this wall.

The Point of Pines area is a highly developed, permanent, middle-class residential district. This northernmost shorefront area of Revere, extending a total distance of 4,600 feet to the General Edwards Bridge, has built-up sand dunes for about 1,500 feet. These combine with a concrete seawall along the remaining shorefront to provide some protection for the area. Flooding occurs primarily from wave overtopping of the existing seawall and, to a lesser extent, the sand dune area.

The area referred to as Oak Island and vicinity includes the salt marshes and land surrounded by the Pines River on the westerly side of the peninsula. Specifically, this reach includes the residential areas on Oak Island, Mills Avenue (Riverside) and in the vicinity of Diamond Creek. Most homes on Oak Island, with the exception of those around the low-lying perimeter, are above the flood damage elevation. This vicinity floods from backwater along the Pines River, caused by the ocean rising during storm events. At the same time, the surrounding wetlands reach their limit of water retention resulting in the inundation of the bordering properties.

(2) Climatology. The climate of Revere is typical of lower coastal New England—variable and characterized by periods of heavy precipitation. Eastern Massachusetts is located within the North Temperate Zone, whose climatology is typical of its latitude and location on the easterly side of a large continent.

New England is influenced by constant conflicts between cold dry air masses flowing out of the great subpolar region to the northwest and the warmer moisture-bearing tropical air from the south. The tendency of most of the general cyclonic disturbances to skirt the polar front brings their paths of movement through the region and results in a somewhat regular succession of biweekly storms. The most active precipitation-producing storms are those in which the moist southwest or east winds flow over the uplands and are forced aloft over cold resident air to condensation levels. In addition, severe coastal disturbances occur when deep low-pressure areas pass over or near the area. A storm of tropical origin may reach the area at nearly full intensity since it has passed mostly over water prior to coming inland. These storms, locally known as "nor'easters," are heavily laden with moisture from the ocean.

Coastal areas, such as Revere are subjected to considerable maritime influence because of their proximity to the Atlantic Ocean. Winters are warmer and summers pleasantly cooler than locations slightly inland of the ocean's

tempering effects. This results in smaller diurnal temperature ranges. Winter coastal storms often bring rainfall to Revere, in contrast to snow in interior portions of the state. Orographic influences on the climate are minor, due to the relatively small extremes of elevation within the area. Hurricanes can occur, however, particularly during August, September and October.

The highest temperature of the year is 90 to 95° Fahrenheit (F). During the summer, nights are usually cool with readings in the 50's and 60's. The average temperature in summer (June - August) is 68°F and varies little from year to year. The average winter (December - February) temperature is about 29°F. During some winters, the temperature may never fall below zero, and yet during others, as many as 20 days with subzero temperatures may occur.

Although the month-to-month average precipitation is fairly constant, and no "wet" and "dry" seasons exist as such, there is a notable decrease in precipitation during summer. The May through August period averages about 2.5 to 3 inches per month, whereas the winter and spring months receive about 4 inches each. Rarely does any month experience more than 10 inches of precipitation or less than 1 inch. Short periods of drought may occur in any season. The annual precipitation, averaging about 43 inches, is fairly constant from year to year and usually provides enough water to combat drought.

The bulk of snowfall occurs from December through March, although measurable amounts fall in April, October, and November. The amount of annual snowfall is subject to wide variation from year to year and from location to location in the metropolitan Boston area.

Tables 1 through 4 summarize temperature, precipitation and snowfall data for Logan Airport, Boston (3 miles to the southeast), and Peabody (6 miles to the north).

(3) Storms. Flooding in Revere is not a new problem. It has been experienced since the area was first settled over 200 years ago. Damages occur on an annual basis, with severe flooding on an average of every 8 years. The more notable storms of record, resulting in significant flooding are described below. Actual recorded damages are sketchy at best. Losses due to the more recent events are documented wherever possible.

26 December 1909

The "Christmas Gale" produced the third highest tide, 10.0 feet NGVD, in over 250 years of unofficial record at Boston. Historical records indicate a wind velocity of about 85 miles per hour was experienced.

4 March 1931

The "nor'easter" of March 1931 brought severe winds and high seas. A maximum tide of 9.2 feet NGVD was recorded in Boston during this storm.

TABLE 1
TEMPERATURE
AVERAGE DAILY

<u>Month</u>	Boston (1872 - 1980) °F	Peabody (1967 - 1980) °F
January	28.8	25.1
February	29.1	26.4
March	37.0	36.3
April	47.1	46.8
May	57.8	56.6
June	67.1	66.2
July	72.6	72.2
August	70.8	70.4
September	64.0	62.4
October	54.1	51.6
November	43.5	44.0
December	32.7	30.2
Annual	50.4	49.0

TABLE 2
TEMPERATURE
MONTHLY EXTREMES
°F

<u>Month</u>	<u>Boston</u> <u>(1872 - 1980)</u>		<u>Peabody</u> <u>(1967 - 1980)</u>	
	MAX	MIN	MAX	MIN
January	72	-13	64	-11
February	68	-18	61	-10
March	86	-8	80	3
April	94	11	91	18
May	97	31	94	30
June	100	41	95	41
July	104	50	98	46
August	102	46	104	40
September	102	34	94	30
October	90	25	84	23
November	83	-2	75	14
December	70	-17	65	-7
Annual	104	-18	104	-10

TABLE 3
PRECIPITATION
(In inches)

<u>Month</u>	Boston (1871 - 1980) Elev. 15 feet NGVD			Peabody (1967 - 1980) -		
	<u>Mean</u>	<u>Max</u>	<u>Min</u>	<u>Mean</u>	<u>Max</u>	<u>Min</u>
January	3.68	10.55	0.35	3.87	11.81	0.68
February	3.36	9.98	0.45	3.56	8.62	0.72
March	3.83	11.75	Trace	4.13	8.37	2.53
April	3.53	10.83	0.20	3.76	7.53	1.50
May	3.25	13.38	0.25	4.13	7.34	2.02
June	3.10	9.13	0.27	3.77	8.51	0.35
July	3.12	12.38	0.52	3.09	7.99	1.18
August	3.61	17.09	0.37	3.61	6.52	1.19
September	3.23	11.95	0.21	3.77	6.77	0.29
October	3.24	8.84	0.06	3.57	6.37	1.25
November	3.83	11.63	0.59	4.98	10.44	0.70
December	3.67	9.74	0.26	5.75	10.58	1.24
Annual	41.45	17.09	-	47.99	11.81	0.29

TABLE 4
SNOWFALL
(Depth in Inches)

<u>Month</u>	<u>Boston</u> <u>(1936 - 1980)</u> <u>Elev. 15 Feet NGVD</u>	<u>Peabody</u> <u>(1967 - 1980)</u> <u>-</u>
January	12.4	13.9
February	11.9	13.9
March	8.0	8.6
April	0.7	1.3
May	Trace	Trace
June	0	0
July	0	0
August	0	0
September	0	0
October	Trace	0.1
November	1.2	2.2
December	7.8	12.5
Annual	41.3	52.5

21 April 1940

The storm of 1940 brought high tides and strong winds. Boston Harbor recorded maximum stillwater tide heights to be 9.3 feet NGVD.

30 November 1944

The tide elevation observed in Boston on 30 November was 8.8 feet NGVD. This storm was classified as a "nor'easter" with strong winds prevailing from the north and northeast.

29 December 1959

During the northeaster of 1959, tides rose to 9.1 feet NGVD causing extensive damage at Revere Beach, with considerable loss of sand and undermining along the seawall due to heavy wave action. Major damage occurred at Roughan's Point (45 homes), Point of Pines (120 homes), and the Mill Avenue area (30 homes). Also many commercial establishments were affected due to overtopping of beaches and walls causing flooding in low areas. Revere suffered about \$1 million in damages at 1959 price levels. This would approximate \$4 million in today's dollars.

26 May 1967

This storm came especially late in the season. The northeaster's movement was slow due to a blocking high pressure ridge, and coincident spring tides combined with gale force winds caused extensive beach erosion. In Boston, maximum tide heights reached 9.0 feet NGVD.

19 February 1972

A deep low-pressure area moving at about 25 miles per hour over outer Cape Cod produced storm surges of 4.0 feet at Boston, superimposed on the coincident spring tides. Observed maximum tidal elevations in Boston reached 9.1 feet NGVD. Revere suffered almost \$1.1 million in damages to public facilities alone. This would be about \$2 million at today's levels.

7 February 1978

While areas were still in the process of recovering from the effects of a 20 January 1978 blizzard, New England was struck by one of the most intense, persistent, severe winter storms of record. The storm moved slowly eastward just south of New England as a circular upper atmospheric low moved over the surface circulation. It produced intensely strong winds including recorded gusts of 79 mph and great amounts of snow over most of southern New England. Tidal elevations in Boston reached the highest recorded at 10.3 feet NGVD. It is estimated that this storm had an approximate frequency of occurrence of once in 100 years. The damages caused by this "Great Blizzard" are discussed later.

21 January 1979

Heavy rains and strong onshore winds galed from the northeast to create high tides and flood conditions in Revere. However, just before the high tide, winds unexpectedly shifted and flood losses were thereby reduced.

(4) Topography and Geology. The Saugus-Pines watershed consists of a distinct region of both upland and lowland topography. Elevations range from sea level to as much as 170 feet above sea level. Revere is in the lowland section, which once consisted mainly of salt marshes and alluvial deposits. This section constitutes less than one-third of the watershed area. Some of this area is now filled. The bedrock underlying Revere is argillite of sedimentary origin locally known as the "Cambridge Slate." The lowland section was deeply buried by glacial till and thick clay.

The ocean floor of Broad Sound, immediately to the eastward, consists of thinly interbedded clay and fine sand, along with some thick layers of fine sand. These deposits are limited in their land distribution to low-lying coastal areas. They are, for the most part, buried beneath younger outwash, salt marshes, and estuarine deposits.

(5) Fish and Wildlife. The study area and Broad Sound contain a variety of fish and wildlife habitats supporting a diverse population of fish and wildlife. There are 31 species of finfish in the area. No endangered species have been identified.

Sport fishing and shellfish harvesting are popular in the area. However, a large portion of the shellfish flats have been closed due to pollution. Only the tidal flats of the Pines River remain open to harvest. Although urban in character, there exists some potential for improvement to the environmental resources of the study area. An inventory of fish and wildlife resources is included as Appendix B.

(6) Social Environment.

. History. European fishermen, explorers, and traders visited the Boston area beginning in the 16th century, and the first European settlement was in the 1620's. Revere, originally called Rumney Marsh, joined the city of Boston in 1634, at which time land was given out to seven families who established farms there. In 1739 the community became part of Chelsea. The study area was called North Chelsea in 1846, and was changed to Revere in 1871.

Completion of the Boston, Revere Beach and Lynn railroad (the "Narrow Gauge") in the 1870's provoked rapid development of the Revere Beach area as a summer resort community. Small summer homes were built in the vicinity of the beach and a hotel, a great pier, dance halls and other recreational facilities were developed.

Not only did the railroad make it possible for people to travel to Revere for recreation, it also made it possible for people to reside in Revere and work in Boston and other communities. Residential development began to occur all

Additionally, completion of the railroad made the city accessible to a regional market. Realizing the potential for tourist attraction and employment, a fantasy-type amusement area called "Wonderland Park" was developed in 1906 adjacent to the railroad right-of-way, directly west of the Revere Beach residential area. The park provided the impetus for further recreational development of the beach and adjoining properties.

The beach and amusements continued to flourish as a major attraction until the 1940's when the quality of the beach and structures began to decline. Increasing public mobility, changing tastes and recreational attitudes, and falling profits all contributed to this downward trend. The deteriorated condition of Revere Beach in recent years, as well as the growing need for quality public recreation areas within the metropolitan region has forced a renewed interest in reversing this pattern and reclaiming one of Boston's most accessible natural resources.

The residential growth of Revere continued and reached another period of rapid development in the Post-World War II period of the 1950's. Most of the housing in the western and northern sections of Revere was constructed during this period.

Because Revere is so closely situated to Boston, heavy traffic conditions, particularly in the peak commuter hours, are a daily characteristic of the city. Several major highways and arteries pass through Revere providing direct access to the Boston central business district area.

As in the case of many older urban centers, Revere is coping with a variety of problems including a declining youth population, deteriorating public utilities, neglected neighborhoods, older housing in need of rehabilitation, and a declining tax base.

. Population and Economy. The city of Revere has a stable population base. No great change has occurred in the past 30 years in approximate total numbers and growth rates, as shown below.

TABLE 5

PAST POPULATION

<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>
36,800	39,600	40,100	42,400	43,200	41,300	42,300

Population projections compiled by the Metropolitan Area Planning Council (MAPC) indicate that Revere's historic trend of a stable population will continue. No great change is expected for the next 40 years as shown below. Demographic projections to the year 2030 are currently being formulated and are expected to remain stable.

TABLE 6
PROJECTED POPULATION

<u>1990</u>	<u>2000</u>	<u>2020</u>
42,600	43,500	44,500

Approximately 50 percent of the Revere population is of Italian descent. Other nationalities represented are Russian and Canadian, but each has only about 10 percent representation.

Approximately 80 percent of the work force employed in Revere work in the services and wholesale and retail trade sectors of the economy. Many Revere residents work in Boston or its suburbs. The Massachusetts Division of Employment Security estimates that there is about 11 percent unemployment. The reported number of available jobs in Revere can employ only 40 percent of the city's labor force. Therefore, a minimum of 60 percent of the labor force works outside city limits (not adjusting for commuters who work in Revere and live elsewhere or for part-time jobs which make up full-time equivalents). This comparison has been made to illustrate that Revere is basically a commuter suburb.

The MAPC has projected that by 1990 manufacturing in Revere will be reduced. Thus, Revere's tax base would become more dependent on local residential property and sales taxes. An examination of Revere finances illustrates that Revere does not have a surplus of funds available for new flood protection facilities and drainage improvement. Any future major improvements or flood protection facilities would probably require a bond issue, substantial State and/or Federal aid, or both.

(7) Cultural and Natural Resources. Man entered New England in the wake of the retreating glaciers, and the earliest known cultural site in this immediate region is the Bull Brook site near Ipswich (about 20 miles to the northeast), dated around 9000 BC. Many prehistoric sites of more recent age have been found in this region. The earlier sites represent people with a hunting, fishing, and gathering adaptation. The later sites represent people who combined farming with other economic pursuits. Boston Harbor may have been one of the richest areas in New England, with its abundant coastal, estuary, river, and land resources. The area seems to have supported a high population until decimating diseases were introduced by Europeans. This population density is reflected in the wealth of prehistoric archaeological sites that have been found here. Unfortunately, most of these sites have been destroyed by the activities of the historic period.

A number of burial sites have been found over the years along Revere Beach. A quotation from Shurtleff's History of the Town of Revere indicates the density of prehistoric archaeological sites which existed here at one time and have since been lost.

"... that the valley extending northward to Woodlawn Cemetery formerly abounded in Indian relics and other indications of Indian occupation, seems to point to these sites as near the dwelling place of the Sagamore. There are indications of an old Indian fort near a brook between Woodlawn and Sagamore Hill, another on the top of Mt. Revere, and still another on Powder Horn Hill. The cutting down of the hill at Crescent Beach near the end of Beach Street, laid open one of those Indian shell heaps which excite so much interest. Many arrowheads have been found near this heap and in various parts of the town, especially along the shore on the ridge at the foot of Shirley Avenue, where the boulevard now runs. Indian pipes and implements of war have been unearthed when digging in the streets and fields of the town. Indian skeletons were likewise found, and in June of 1881, two of them were unearthed from a gravel bank near the Pavilion. The remains of an old Indian burying ground were discovered on the Sewall estate, Revere Street, where now stands the Italian church; ..."

No important prehistoric, historic, or paleobotanical resources that would be impacted by any new flood protection facilities were found in the study area. The lack of cultural resources is attributed to natural tidal action or severe disturbance by previous construction. However, Revere, like other coastal areas, presents special problems with regard to the identification of some prehistoric resources. Due to the postglacial rise in sea level and the intentional filling of some low areas to make them habitable, some resources are deeply buried.

The National Register of Historic Sites lists one site, Slades Spice Mill in Revere. It would not be affected by any new flood protection facilities in the study area.

The existing aesthetic features of the environment are deteriorated. Urbanization has contributed greatly to this condition. However, the aesthetic potential of seashore property is the study area's principal resource. It should be remembered that the Revere Beach area was once a resort haven.

The assets of Revere are numerous, beginning with its location. Situated just 5 miles north of the city of Boston, Revere has direct highway and transit access to every portion of the metropolitan region. Five major highways pass through Revere, linking the city to the northern portions of Massachusetts and New England, and south to Boston and Interstate Routes 95 and 93. The Massachusetts Bay Transportation Authority's (T) Blue Line, which terminates in Revere at the Wonderland Station, connects the three Revere stops to Logan International Airport, downtown Boston and the other T transit lines.

(8) Land Use. Revere has approximately 7 miles of beach and ocean shoreline. Revere Beach, owned and operated by the MDC, was the first public beach in the country. The beach is still a major recreational resource for the city and the entire metropolitan region. Although the city is densely developed, much of the area is still characterized by open water and tidal

marsh. The Pines River forms approximately 500 acres of marshland just west of Revere Beach, Point of Pines and Oak Island.

This Saugus/Pines River marsh is the largest tract of undeveloped land in Revere and pressures for filling and developing the marsh increase daily. The Seaplane Basin in north Revere was partially filled in preparation for construction of Route I-95. Although the highway construction was halted years ago, the fill material remains and could be used for other purposes.

D. PROBLEMS, NEEDS, AND OPPORTUNITIES

The 1980 US Census reported 17,163 residential structures in Revere. In the 1978 storm about 1555 homes, or approximately 9 percent, were damaged. Total estimated flood damage for a recurrence of the 1978 flood would be \$14.3 million. Losses to residences would be \$10.5 million, or about 73 percent.

The 1978 flood, used as the index for measuring the severity of damages in Revere, came directly after a severe blizzard. When the damage survey specialists from the Army Corps of Engineers assessed damages they separated these flood losses into two types--physical and nonphysical. Physical losses include such things as damage to structures and contents. Nonphysical losses take into account a wide variety of losses attributable to flooding, such as loss of work, and costs of temporary housing and food.

Other expenses are associated with severe flooding. In addition to the measured damages previously discussed, are one-time losses associated with flooding which are accountable as damages. These costs include the expenditures by the 20 Federal, state, and local emergency assistance programs that were put into action. These emergency expenses accrued due to both the storm and the flood. At least some of these expenditures would be prevented by additional protection. The city of Revere provided a list of the agencies involved in emergency operations during the 1978 storm and also in the subsequent rehabilitation operations. The list includes:

1. The Department of Housing and Urban Development (HUD)--community block grants, temporary housing, insurance and repairs.
2. The Small Business Administration (SBA)--low interest loans.
3. The Department of Labor (DOL)--unemployment insurance.
4. The Department of Agriculture (DOA)--food stamps
5. The Federal Disaster Assistance Administration (FDAA).
6. The Community Services Administration (CSA)--grants for food and fuel.
7. The Department of Health, Education and Welfare (HEW)--grants to the elderly.

8. The Federal Highway Administration (FHA).
9. The Army Corps of Engineers (CE)--emergency rehabilitation.
10. The Massachusetts National Guard.

In addition, there were extraordinary expenses incurred by the Revere police and fire departments, and by the MDC. The following analysis of flood damages was obtained from field damage surveys, interviews with local residents and information provided by the city of Revere.

(1) Roughan's Point. This area is bounded by Eliot Circle, Atlantic Avenue, Endicott Avenue, and the ocean. It is a very compact neighborhood with a church, a synagogue, a local school and some commercial establishments. In the 1978 flood, the area suffered the heaviest losses in Revere. The existing concrete seawall runs along the easterly face but does not extend along the north shoreline. This leaves this area particularly vulnerable to high waves. In the 1978 flood, the water level was high enough to damage the first floor of many homes.

The total estimated average annual flood losses at Roughan's Point, based on the full range of flood events, are approximately \$1.2 million. There would be about 270 residences damaged during a recurrence of the 1978 flood. Total annual physical and nonphysical damages to residential structures are estimated to be \$1.0 million or an average annual loss of \$3,700 per residence. The attached newsclip in Appendix A, taken from the Boston Globe of 19 February 1978, vividly depicts the hardships suffered by Beachmont residents during the "Great Blizzard."

(2) Revere Beach. This portion extends from Roughan's Point northward to Point of Pines. Average annual damages based on a full range of flood events, are estimated at nearly \$1.0 million. Annual losses to 380 residences are about \$950 per residence. Commercial damage would be divided among 40 establishments, with the Wonderland Dog Track suffering the greatest estimated loss. Damage to public property in a recurring 1978 flood would include two schools, MDC property and the Wonderland T station.

(3) Point of Pines. This is a well-defined neighborhood north of Revere Beach bordered by the ocean and the Lynnway. It is a higher income area than Roughan's Point, with larger homes and yards. There is a fire station, a school, two churches, and several commercial establishments in the neighborhood.

Total average annual damages are estimated at \$515,000. There are 310 residences averaging losses of \$1,260 annually per home. The flooding at Point of Pines was not as severe as that at Roughan's Point. Much of the damage was caused by the flooding of basements with damage to furnishings, heating systems, plumbing, and stored belongings.

(4) Oak Island. This vicinity floods from backwater along the Pines River caused by the ocean rising during storm events. At the same time, the surrounding wetlands reach their limit of water retention resulting in the inundation of the bordering properties.



ROUGHAN'S POINT

11 FEBRUARY 1978



OAK ISLAND AND REVERE BEACH

11 FEBRUARY 1978

Total average annual losses are \$465,000; 615 residences average \$555 annually per home.

Table 7 summarizes estimated annual losses by area and category, not including costs incurred by emergency services.

TABLE 7
ANNUAL FLOOD LOSSES
(In \$000)

<u>Category</u>	<u>Roughan's Point</u>	<u>Revere Beach</u>	<u>Point of Pines</u>	<u>Oak Island</u>	<u>Totals</u>
Total	1,200	1,000	515	465	3,180
Residential	1,000	362	390	342	2,094
Number of Homes Affected	270	380	310	615	1,575
Average per Home	3.7	1.0	1.3	0.6	1.3

E. THE WITHOUT CONDITION

Revere has experienced a very slow rate of growth over the past 30 years. In fact, 1980 census figures indicate that the city lost some 900 people between 1970 and 1980. Population projections predict minimal growth for the city through the year 2020 (see Tables 5 and 6). Due to the severe flooding caused by the February 1978 storm, and, to a lesser extent, the January 1979 storm, many homes have undergone or are awaiting floodproofing measures through the Massachusetts Coastal Floodproofing Program. This program was funded by the Department of Housing and Development, which provided grants and technical advice to low and moderate income homeowners. To date, 42 homes in Revere have received financial assistance in raising homes or utilities as a flood damage reduction measure. Additionally, few people have sold their homes in this area after these storms.

(1) Development. Revere is currently considering a number of economic revitalization plans. The objectives of the city's general development strategy as outlined in their Recreation Recovery Action Plan include the stabilization of neighborhoods and the tax base; the expansion of industrial and commercial efforts; development of the city's 3-mile long beachfront, its greatest asset; and the improvement of overall public facilities.

Future plans directly related to the study area include:

- . Cleaning and restoration of Sales Creek to improve drainage in the lower Beachmont area. Phase 2 of the city's multiphase plan has been completed. Other phases will be completed pending availability of funding.

- . Continued utilization of the Massachusetts Coastal Floodproofing Program (total remaining funds of \$317,000) which provides low cost loans to homeowners to make repairs above flood level or raise utilities such as heat and electricity to a safe level. Some homeowners are involved in this program; others are on a waiting list.

- . Development of the Revere Beach plan, a large scale redevelopment plan involving a private developer, the MDC, and the city of Revere. The plan involves new apartment and condominium complexes, improved traffic patterns, the upgrading of Wonderland Station and existing parking facilities and a commercial area between the complexes.

- . Construction of a new waterfront park by the MDC along the site of the former amusement complex.

- . Renovation of two abandoned schools in the Beachmont section of Revere for conversion into elderly housing complexes.

- . Development of flood control alternatives for the Revere coastal area by the Corps of Engineers.

(2) Flood Threat. As evidenced by the severe flooding caused by the February 1978 storm and the losses suffered on an annual basis, the study area is insufficiently protected by existing flood protection facilities.

It is assumed that Revere will control growth within the flood plain as required under its participation in the National Flood Insurance Program. This implies that Revere would not develop a structural flood protection alternative without Federal participation.

Under the Flood Insurance Program, flood losses would be only partially covered as there are no existing provisions for compensating policyholders for nonphysical losses, such as expenses for lodging during dwelling rehabilitations or loss of income or profit while a commercial or manufacturing firm is temporarily closed.

Another impact associated with severe flooding and extensive property losses is the psychological pressure exerted upon individuals during a crisis situation. Project Concern was instituted in response to the mental health needs of these storm victims.¹ Over 415 people from Revere received professional help from these case workers. Residents' problems encountered by the staff included stress, phobic reactions, anxiety, broken homes, displacement and personal loss.

Crisis counseling for emotional and psychological problems associated with blizzard/flood of February 1978. Sponsored by National Institute for Mental Health and Federal Disaster Assistance Administration. Implemented by the Massachusetts Department of Mental Health and Research for Social Change, Inc.

F. PLANNING CONSTRAINTS

In formulating a plan, constraints will be identified which could affect the way in which the area's problems are addressed. Some constraints may be treated on an individual basis while others are analyzed on a system or subsystem basis. Planning efforts should not render ineffective the objectives of other planning agencies. Proposed plans should complement regional long range management plans. State programs for water and related land uses are described under "Plans of Others." Formulation of a plan in later stages could be constrained by the Commonwealth of Massachusetts' Coastal Zone Management Program, or the environmental provisions of Section 404 of the 1972 Clean Water Act should a particular plan call for discharge of fill material into regulated waters.

The Coastal Zone Management Program provides that:

"Each Federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs."

This includes any development project involving a building or other structure or the alterations of terrain or a body of water, conducted by or on behalf of the Federal government.

G. STATEMENTS OF PROBLEMS AND OPPORTUNITIES

The Corps of Engineers seeks plans that provide solutions for existing flood problems and also offer the potential for reducing future flood damage within the study area. Based upon a preliminary assessment of the flood problems, needs and opportunities in the study area, the following problem statements and opportunities have been developed.

- . Reduction of potential flood damage along the coastline of Revere.
- . Reduction of Revere's exposure to flood related physiological tensions.
- . Development of flood damage reduction program which is compatible with or enhances recreation value of adjoining shoreline and facilities.

These objectives were compiled from meeting with state, regional and local officials. They are based upon information collected to date. More definitive statements will emerge as the study progresses and is refined. This interactive planning process will involve:

- . Addressing specific flood problems and issues, and those concerns identified by the public;
- . Flexibility in accommodating changing economic, social and environmental patterns and technologies;

- . Integrating and complementing other urban development and management programs;
- . Coordinating with affected public agencies at all levels;
- . Developing plans through an orderly, structured and open planning process;
- . Capability of implementating plans, with respect to financial and institutional capabilities and public consensus; and
- . Where applicable, receiving approval by appropriate state and Federal agencies.

In order to meet the goals and objectives of this study, the planning process will consist of the following:

- . Development of a series of alternative flood protection plans to meet future needs, from which a choice may be made prior to completion of the study;
- . Evaluation of that portion of each alternative designed to meet immediate needs; and
- . Where appropriate, a proposal for congressional authorization of selected elements of the publicly selected "best" plan, when these selected elements are traditional Federal responsibilities.

SECTION III

PRELIMINARY PLAN FORMULATION

SECTION III

PRELIMINARY PLAN FORMULATION

A reconnaissance level report calls for determining whether the problems identified can possibly, and economically, be solved. The illustrated measures need not be selected for further plan development, but need only prove that implementable plans warranting Federal participation exist. In developing these plans, the institutional arrangements, data collection work items and relevant plans of others are taken into consideration.

A. PLANS OF OTHERS

(1) State. A variety of Commonwealth of Massachusetts comprehensive plans and programs have a direct bearing on water and related land uses in the study area. Those relevant to this study are described here.

. Statewide Comprehensive Outdoor Recreation Plan (SCORP) prepared by the Department of Environmental Management (DEM), and recommends that recreational needs be met where demand is greatest and supply most deficient, and that priority be placed on satisfying the needs for the most widely demanded recreational activity. The plan identifies swimming as the most popular recreational activity and finds that urban areas, particularly the greater Boston area, have the highest need for new recreational facilities.

. State Growth Policy Plan, prepared by the Office of State Planning (OSP), recommends that new growth and development be channeled to existing urban centers or to regional development centers, and that state actions, particularly state programs of public investment, adhere to the policy and support urban redevelopment.

. Coastal Zone Management Program (CZM) offers technical assistance to communities, provides for Federal consistency with policies, and above all, sets a high priority on placing the state's regulatory and management programs in order and making them work in a more assured, timely and consistent manner. The Massachusetts CZM program protects the coastline's natural resources and insures that the environmental and economic values of the coastal zone will be sustained, and even enhanced.

(2) Other. Plans have been prepared by the city of Revere, the MDC, and private concerns for redevelopment of the beach area. These include the construction of two residential complexes, one to be luxury apartments and an elderly housing project, and the other to be condominiums. The MDC is building a park and the T is planning to extend the Blue Line public transportation system, rebuild the Wonderland Station, and construct a parking garage.

B. INSTITUTIONAL ARRANGEMENTS

To insure that water resources plans developed during the study are implementable, close coordination will be maintained with local, state, regional

and other Federal agencies in the formulation of institutional arrangements. Each alternative will contain a number of alternative implementation arrangements which may require different institutional arrangements.

By definition, an "institution" is a process or organization that is highly structured, systematized, and stable. Institutional structures may be organizations such as planning agencies, water commissions, sewer boards, or special interest groups; or they may be formalized practices or procedures such as home rule, tax structures or financial obligations. "Institutional analysis" is a process whereby institutions, directly or indirectly related to water resources planning and management, are identified and their capability to implement alternative plans is assessed. "Institutional arrangements" are those tasks or procedures which suggest how existing institutional structures should be utilized or modified, new institutions created, or existing institutions abandoned in order to facilitate implementation of the recommended plan.

(1) Analysis. To insure that each alternative developed in the study is implementable, a thorough analysis of the institutional structure required for such implementation must be undertaken. This will define problems or issues within the study area and develop technical alternatives for solutions to those problems. Institutional arrangements designed specifically to implement the alternatives will then be recommended. Analysis of institutional capabilities to implement the flood protection plans developed in the study include organizational information, scope of operation, financial strength and capacity, jurisdiction, and relationship with public interest groups and other agencies.

Such analysis parallels the overall planning process, moving from broad collection to specification of detailed institutional arrangements for implementation. Assessment of existing institutional capability to implement the alternative plans, and recommendations for modifications to make such institutions more effective, will naturally follow.

The analysis conducted as part of this study will concentrate on those institutional structures directly associated with the problem. Overall, institutional analysis will focus on the organizational and financial analysis of government agencies, primarily at the local level, as alternative flood protection plans for Revere may be a predominantly local government responsibility.

Although Federal and interstate government agencies perform various functions, state and local governments share major responsibilities for water resources planning, regulation, technical and financial assistance, and policy development. Primarily the state and local government agencies provide the framework for existing institutional structures.

As is typical of the rest of New England, Revere is characterized by a tradition of strong local involvement in all resource decisionmaking. Special interest organizations and citizen groups also play a vital role in influencing decisionmaking. Appendix D identifies some of the institutions that have a significant interest in water resources management within Revere.

C. STUDY MANAGEMENT

Study management is concerned with the entire conduct of the study. This reconnaissance report, subject to revision as study plans are refined or modified, will serve as the overall guide to management of the study. All parties responsible for the study will insure that the various tasks are accomplished in keeping with outlined schedules.

Strong study management is needed to assure a sound and orderly process leading to plan selection. In order to achieve this, study management will be provided by the Corps of Engineers. The Revere Citizen's Advisory Committee (CAC), The Pines Riverside Association, and the Revere Office of Planning and Community Development will serve on a study workshop committee to assist in study coordination and plan formulation. This proposed organizational pattern may be modified as the needs of the planning effort become more firmly established.

(1) Responsibility. The Commander and Division Engineer, New England Division, US Army Corps of Engineers, will have overall responsibility for the conduct and management of the Revere Coastal Flood Protection Study. A multidisciplinary unit will comprise the study team. Study coordination will be accomplished by the New England Division, Basin Management Branch, augmented by expertise provided by other offices in the Division organization. The day-to-day operation of the study will be the responsibility of the study manager.

Study progress will be monitored by the study manager, who will be responsible for the time, cost and work effort schedules outlined in this reconnaissance report. Modifications to the report will be the responsibility of the Corps of Engineers in response to recommendations from the advisory group.

(2) Coordination. The study workshop committee will:

- . Advise on programs and major work items.
- . Participate in public involvement activities.
- . Coordinate their respective interests, policies and programs with the study.

D. DATA COLLECTION AND BASIC STUDIES

Data needed as the foundation for major work tasks will be generated at the earliest practical date in the study. The efforts required in the basic studies areas of the planning process are described briefly in the following paragraphs.

(1) Socioeconomic. Studies identifying and evaluating present and future socioeconomic conditions in the study area will be developed. Population projections and economic data, including land development trends, will be used to assess and evaluate the impacts produced and study objectives achieved by alternative flood protection plans.

(2) Institutional. A preliminary survey of major public institutions was initiated during preparation of this reconnaissance report. A more detailed survey will be undertaken during Stage II in order to assess the capability potential of the various Federal, state, regional and local public institutions in Revere. Public documents will be surveyed to develop a data base on each institution's legal authority, functional role, program responsibility, and organizational structure. Information on, and analyses of, institutional capabilities for this study will be used to evaluate the capabilities of institutions to implement each alternative plan. Decisions will be made for each alternative plan as to the need for the modification of existing institutions or legislation, or the creation of new institutions or legislation to implement plans.

E. PUBLIC INVOLVEMENT

(1) General. The development and subsequent implementation of sound flood protection plans is keyed to how effectively the public has been involved in all phases of the study process. Such participation assists planners in defining study objectives and priorities, and develops channels through which ideas and information can be shared by all participants.

In the broadest sense, the public consists of all non-Corps of Engineers entities: Federal, state, local and regional agencies as well as public and private organizations and the general public. Initial identification of the public has been made during the preparation of this reconnaissance report and may generally be categorized into three distinct, yet related, groups consisting of the governmental sector, special interest groups and the general public.

The primary objective of the public participation program is to provide continuous two-way communication to involve the public in the overall planning process. By keeping the public informed about the study's progress, interested persons can assist in the making of decisions affecting them. Because major decisions made throughout the study will be based upon the expressed needs and objectives of all local, state and regional officials and members of the general public, it is necessary to establish a program to channel information concerning the study to interested participants and to relay their responses to those conducting the study.

The public involvement program proposed for the Revere Coastal Flood Protection Study will be closely coordinated with other water resources planning efforts being conducted by local, regional, state, and Federal agencies. The Corps will have responsibility for conducting the public involvement activities in cooperation with the Commonwealth of Massachusetts, and the city of Revere.

(2) Objectives. The following objectives have been established to insure that the public's interests and desires are considered and acted upon:

- . Provide information which will assist the public in the definition of water and related land resources problems within the study area and the concerns, objectives and priorities of its citizens so they may effectively participate in the study.

- . Foster an understanding among study participants in which free exchange of ideas is possible and develop channels through which public concerns, preferences and priorities will be heard and considered.

- . Develop a structure to give the public an opportunity to influence the formulation and evaluation of planning alternatives, to identify and resolve conflicts where they may arise and to achieve consensus on all study courses of action.

- . Establish a control system which is flexible and can be modified in response to the study needs as they are identified.

- . Establish a system of coordination between this study and water resources planning efforts of other Federal, state, regional and local agencies.

(3) Interactions. Implementation of the public involvement program will occur during each stage of the study. The plan is structured to provide the public with the public with a better understanding of the entire planning process as the study progresses from one stage to the next. The preparation of this reconnaissance report (Stage I), Development of Intermediate Plans (Stage II), and Development of Final Plans (Stage III) requires the iteration of planning activities at successively greater levels of detail, effort and refinement. Each stage is conducted by carrying out the four functional planning tasks of problem identification, formulation of alternatives, impact assessment and evaluation during plan development.

During problem identification, public involvement efforts are directed to:

- . Inform the public about the study effort.

- . Obtain data to assist in the identification and description of flood protection problems, concerns and opportunities.

- . Obtain an indication of the relative priority of planning objectives from a public point of view.

- . Solicit information concerning the public's environmental, social and economic desires.

- . Obtain public review and reaction to the results of problem identification.

Specific work tasks include preparing a public contact list, an information fact sheet and other study announcements and brochures, materials for workshops and speaking engagements; a list of repositories for study documents; and analyzing public involvement feedback.

Implementation mechanisms used during problem identification include mailings and media presentations, briefings of officials and leaders, and public workshops and meetings.

Public involvement aids in assuring that the alternatives developed address the full range of problems and concerns as perceived by the public in response to stated planning objectives. Specific public involvement objectives during this phase will include:

- . Informing the public and obtaining their feedback about the various technological and managerial measures available for meeting stated objectives.
- . Obtaining public review of and reaction to alternative measures and plans.

Specific work tasks to be accomplished during the formulation of alternatives include preparation of materials, including brochures on alternative programs; preparation for workshops and public meetings; dissemination and presentation of materials to various groups and organizations; and analysis and evaluation of the program.

Public involvement during impact assessment concentrates on identification and measurement of the impacts of flood protection plans as they relate to the entire study area and the general public. Substantial public involvement is encouraged so that the public is aware of each alternative plan and its impacts. Major objectives of public involvement during the impact assessment phase are:

- . Obtain information about interest groups, primarily those concerned with each class of impacts in order to identify those groups and individuals to be specifically consulted during evaluation.
- . Describe the elements and impacts of each alternative plan and obtain public input on the significance of impacts to each affected interested group.
- . Obtain additional input for each succeeding iteration.

Work tasks to be accomplished include preparation of materials describing concepts used in impact assessment, dissemination of materials on impact alternatives, solicitation and recording of reactions and preferences concerning impact of alternatives, oral presentations to interested groups and public forums, and interpretation of public reaction.

Specific public involvement objectives during the evaluation of alternative plans include:

- . Obtaining public input concerning the acceptability of alternative plans.
- . Ranking alternatives in terms of their contribution to planning objectives and public acceptability.
- . Allowing public interests to discuss disagreements, if any, with a goal of arriving at a mutually agreeable solution.
- . Summarizing information on the evaluation of alternative plans.

In addition to public forums, both progress and informational meetings will be held to maintain close cooperation of study elements with all study participants. The progress-type meetings would be a working session of the advisory group. This procedure will enable study participants to discuss the study, focus attention on specific problem areas, and analyze the legal and institutional framework required for effective plan implementation.

Work tasks to be undertaken include preparation of materials dealing with the overall objective of program analysis and the concept of trade-off analysis, presentation and display of plans; final impact comparisons; solicitation and documentation of reactions and preferences; interpretation of public reactions, and meeting with public groups to establish final decisions on plans and programs.

(4) Schedule. Progress meetings with a study workshop committee will be held on a bimonthly basis, in accordance with the purposes and tasks outlined previously.

During the course of the study, information meetings will be held where the public can participate, ask questions and express opinions. The format for these workshops will consist of a presentation by the Corps of Engineers, followed by public discussion and interaction with the study team. These workshops will be as follows:

A plan formulation workshop during Stage II, and a late stage public meeting at the completion of the detailed study.

F. MAJOR WORK ITEMS

A brief description of the various efforts to be performed in the development of a flood protection system is presented below. The efforts are described for each of the four functional tasks of the planning process: problem identification, formulation of alternatives, impact assessment, and evaluation. The actual plans will be developed concurrently in order to formulate the best overall solution.

(1) Problem Identification. Flood problem identification, in subsequent stages of this study, will concentrate on detailed surveys, and hydraulic and economic studies in areas subject to flooding. In those areas where changes are expected to have a significant impact, existing and future conditions will be analyzed to determine their effects.

(2) Plan Formulation, Impact Assessment and Evaluation. Formulation of the alternative plans for the study area will consider both structural and nonstructural measures to satisfy their flood protection needs. Study efforts will include the accomplishment of detailed hydrologic investigations, hydraulic studies, geotechnical studies, surveys, civil engineering, relocation studies and real estate considerations. Nonstructural measures such as flood insurance, permanent evacuation, floodproofing, structure raising and zoning ordinances will be considered in lieu of and in conjunction with structural alternatives.

Assessment and evaluation will include benefit-cost analyses of all formulated alternatives. Economic, social and environmental assessments will be made and impacts on the study area, resulting from plan implementation, will be evaluated. Flood protection alternatives will be selected for the NED and EQ plans.

G. FINAL REPORT

Study findings of the study will be continually documented and updated during each study phase to assure that study progress and findings are given effective public exposure. Analysis of these study documents by all study participants will form the basis for final decisions.

Roughan's Point, Point of Pines, Oak Island and Revere Beach will be investigated separately.

Stage II documentation and an interim report will be prepared for the Roughan's Point area, as an incrementally justified plan (that is complete within itself).

While Stage III studies for Roughan's Point are in progress, Stage II documentation will be prepared for the remaining areas of Revere (Revere Beach, Point of Pines and Oak Island). A final authorization report for the entire Revere coastal area will be prepared, which will incorporate the highlights of the Roughan's Point study findings.

The interim and final authorization report will each consist of a summary report, together with the following supporting appendices:

Appendices

1. Problem Identification
2. Formulation, Assessment and Evaluation of Detailed Plans
3. Public Views and Responses
4. Engineering Investigations, Design and Cost Estimates
5. Recreation and Natural Resources
6. Social and Cultural Resources
7. Economic
8. Others as Needed

Continuous drafting of these documents will be accomplished throughout the progress of the study to assure that study progress and findings are given effective public exposure. Analysis of these study documents by all study participants will form the basis for final decisions.

SECTION IV

PRELIMINARY INVESTIGATIONS

SECTION IV

PRELIMINARY INVESTIGATIONS

A. MANAGEMENT MEASURES

Flooding problems were identified throughout the Revere coastal area. Possible structural and nonstructural solutions were then analyzed (see Table 8). This section contains material relative to structural and nonstructural alternatives.

Structural measures affect the floodwaters, while nonstructural measures affect activities in the flood plain. Nonstructural solutions may involve alternative land uses for the flood plain. Most nonstructural solutions to existing flood problems are applied directly to each flood plain property or activity. Normally, nonstructural measures are not expected to provide as high a degree of protection as structural measures.

Structural components are often used to control floods and reduce damage in heavily urbanized flood prone areas, if these measures are not environmentally or socially undesirable. Walls and berms provide protection by preventing wave overtopping and holding back floodwaters. Offshore breakwaters protect by disrupting waves before they reach the shore. Sand dunes work like walls and berms but require large amounts of available land to be practical.

In some locations nonstructural measures such as floodproofing, raising or relocation may be appropriate, or some combination of both types of measures may be warranted. In the Charles River Basin in Massachusetts, for example, a structural flood control reservoir at the mouth of the river was combined with an upstream nonstructural natural valley storage program to provide flood protection for the watershed.

Strictly speaking, only floodproofing and flood warning systems can reduce flood damage without changing land use. Evacuation or relocation of flood plain activities also reduce flood damages but at the cost of denying the activities removed from the flood plain. For this reason, the Corps of Engineers past studies of evacuation or relocation alternatives confirm that these measures can be difficult to justify from an economic point of view. There are two types of situations for which they can be justified. First, and most importantly, in those situations where there is some alternative use of the land which is compatible with the flood hazard and which provides a higher return than the current flood plain activities. An example of such a situation is when a flood plain is sparsely developed and has a high potential for use as a greenway, a park or a fish and wildlife area.

TABLE 8

FLOOD PROTECTION PLANS TO BE CONSIDERED

I. STRUCTURAL MEASURES

1. Walls
2. Stone Berms (Riprap)
3. Offshore Breakwaters
4. Sand Dune Systems

II. NONSTRUCTURAL MEASURES

1. Floodproofing Existing Structures
2. Warning and Evacuation
3. Relocating Existing Structures
4. Raising Existing Structures
5. Zoning Ordinances, Subdivision Regulations, and Building and Housing Codes

Another example of a situation for which there may be substantial economic benefits from evacuation of existing flood plain activities is when the flood plain lands are suitable for economic redevelopment. Specifically, urban renewal of flood plains in decaying areas of our older cities is one such case. By clearing old flood plain areas and redeveloping them within strict guidelines which insure that all new uses are compatible with the flood threat, major economic benefits may result and major flood hazards may thereby be reduced.

Corps policy has consistently required a case-by-case analysis of flood problems with the intention of reducing flood damages in any given situation only when the benefits to be obtained exceed the costs. This flood control policy remains fully grounded in benefit-cost analysis although we have extended the concept of benefits and costs beyond traditional economic values to embrace a full range of environmental effects as well. In summary, a project may recommend permanent flood plain evacuation, green space, and similar measures, but only if economically and environmentally justified.

Nonstructural and structural alternatives need not provide the same level of protection. While variation in the level of protection makes a comparison of plans and consideration of trade-offs more difficult, it is essential if each alternative approach, whether structural or nonstructural, is to be presented in its best light.

During the course of the study, preliminary plans were evaluated for feasibility in satisfying flood protection needs and economic justification. These plans were formulated to decide if further studies should continue on formulating an EQ plan or other alternative plans. The following illustrated measures need not be selected for further plan development, but need only prove that implementable plans exist.

B. ROUGHAN'S POINT

Several alternative plans for providing flood protection for the Roughan's Point area were initially considered under the Section 205 study. They included: (1) raising the existing concrete wall 6 feet and constructing a new concrete seawall from Simpsons Pier to Eliot Circle, (2) constructing a stone breakwater offshore, (3) placing a floating breakwater offshore, (4) raising the existing 33 acres of flood prone land by 10 feet, including 220 houses, and (5) building a stone berm on the ocean side of the seawall.

Plan (5) was initially determined the most reasonable plan providing a high degree of protection with minimum adverse impact on local residents and the environment. Raising the existing seawalls would most likely be objectionable to some residents as it would obstruct their view of the ocean. Offshore stone breakwaters would be expensive to construct and maintain. Floating breakwaters would be ineffective against severe storms and filling of the existing flood prone area would be highly disruptive to local residents.

It is estimated that approximately 5500 linear feet of stone protection could be placed from Short Beach to Eliot Circle on the ocean side of the existing seawall, at a project first cost of approximately \$15 million (see Plate 3).

Utilizing current rates of interest and amortization the annual cost of flood protection at Beachmont would be \$1.1 million. This analysis results in a positive benefit-to-cost ratio of 1.1 to 1.0. This plan is complete within itself and is incrementally justified.

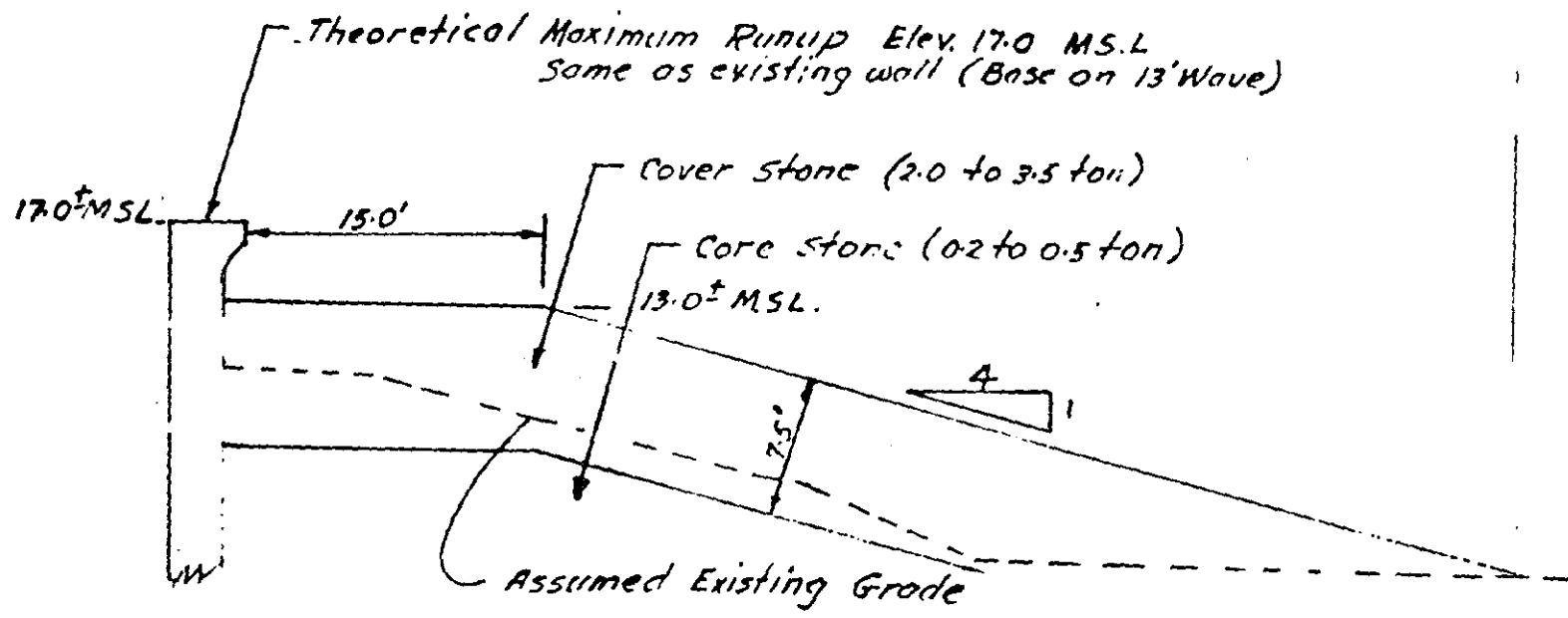
C. REVERE BEACH

This reach extends about 13,000 feet from Eliot Circle, along Crescent and Revere Beaches, to Carey Circle. Although most of the beachfront properties (arcades and amusement park) are gone, there is considerable pressure for private redevelopment of the area. During the February 1978 storm, high waves and the tidal surge overtopped the seawall (top elevation 16+ feet above NGVD), inundated Revere Beach Boulevard and ran down to Ocean Avenue and the backshore area, thereby adding to the volume of water that was backing up through drainage ditches from the unusually high tides on the Pines River. These high energy conditions were generated by winds from the north and northeast and by an abnormally high tide. Considerable damage was sustained in low-lying areas along Ocean Avenue and North Shore Road and the T Wonderland Station was closed for several weeks due to the flooding.

Several alternative plans for reducing flood losses due to wave overtopping of the Revere Beach seawall were investigated. In the analysis of this flood zone it must be emphasized that complete flood protection for the backshore area could not be accomplished by improvements along the beachfront alone. Other improvements would have to be accomplished to prevent tidal backwater inundation through the system of tidal ditches which discharge to the Pines River. This could be accomplished by the construction of dikes and pumping stations (possibly along the B&M railroad embankment) or by construction of a hurricane barrier across the entrance of the Pines River in the vicinity of the General Edwards Bridge.

Basically, the alternatives studied for the Revere Beach reach included (1) removal of the existing seawall and replacement with either a stepped concrete wall or curved face wall with a top elevation three to four feet higher than the existing wall, (2) raising the existing roadway elevation of the Revere Beach Boulevard from Eliot Circle to Carey Circle, (3) driving steel sheet piling on the beachside of the existing concrete wall, (4) raising the embankment between the Revere Beach Boulevard and Ocean Avenue south of Revere Street and providing drainage outlets from the roadway to the beach (this plan is essentially the same as current MDC plans), (5) constructing a three to four foot high concrete "cap" on top of existing seawall, and (6) replenishment of beach sand to dissipate wave energy away from the existing seawall. These plans had estimated first costs ranging from about \$7 million for the beach restoration to over \$17 million for the construction of a new, higher, seawall. (A sketch plan of the beach restoration is shown as Plate 4).

Plan (6) was studied recently by the Corps of Engineers in cooperation with the MDC. That study found replenishment of the beach to be technically feasible, but not economically justified. All other plans for flood control were also found impractical or not economically justified. In light of these findings, additional investigations will be needed to integrate protection of Revere Beach with that of Roughan's Point, Point of Pines and Oak Island.



ROUGHAN'S POINT

STONE BERM

REVERE, MASS.
Scale 1"=10.0'

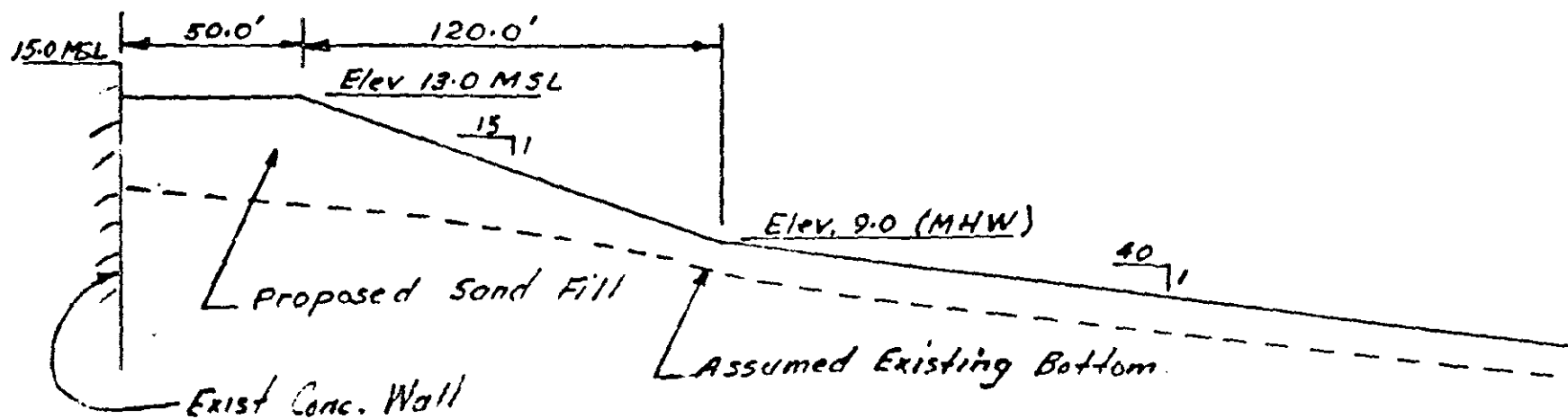


PLATE 4

REVERE BEACH

RESTORATION

Horz. Scale 1"=50'
Vert. Scale 1"=10'

D. POINT OF PINES

Point of Pines extends for a distance of about 4600 feet from Carey Circle to the mouth of the Pines River at the General Edwards Bridge. Although this area is not as exposed to coastal flooding as the Roughan's Point area, due to protection from the Lynn-Nahant Causeway, it did suffer considerable damage during the February 1978 blizzard when the seawall was overtopped. The residential streets extending off Rice Avenue were inundated by sheet flow. Because of snow and slush on the ground these flows ponded and could not reach the pumping station located near the bridge. The existing shorefront at Point of Pines has several different sectional configurations, including concrete wall with revetment, concrete wall without revetment, stone slope protection and sand dunes. Approximately 1500 feet of the total length consists of sand dunes located at the far northerly end of Point of Pines.

The basic plans of protection for this area would be similar to those previously discussed, namely, raise existing seawalls, construct new—higher seawalls, place rock protection on the oceanside of the existing seawall, and raise the existing sand dunes. Because raising the existing seawall four to six feet would be expected to be objectionable to residents of Point of Pines, the seawall plan would include placement of a cover layer of stone on the oceanside and placement of additional sand along the 1500 foot reach of the existing sand dunes.

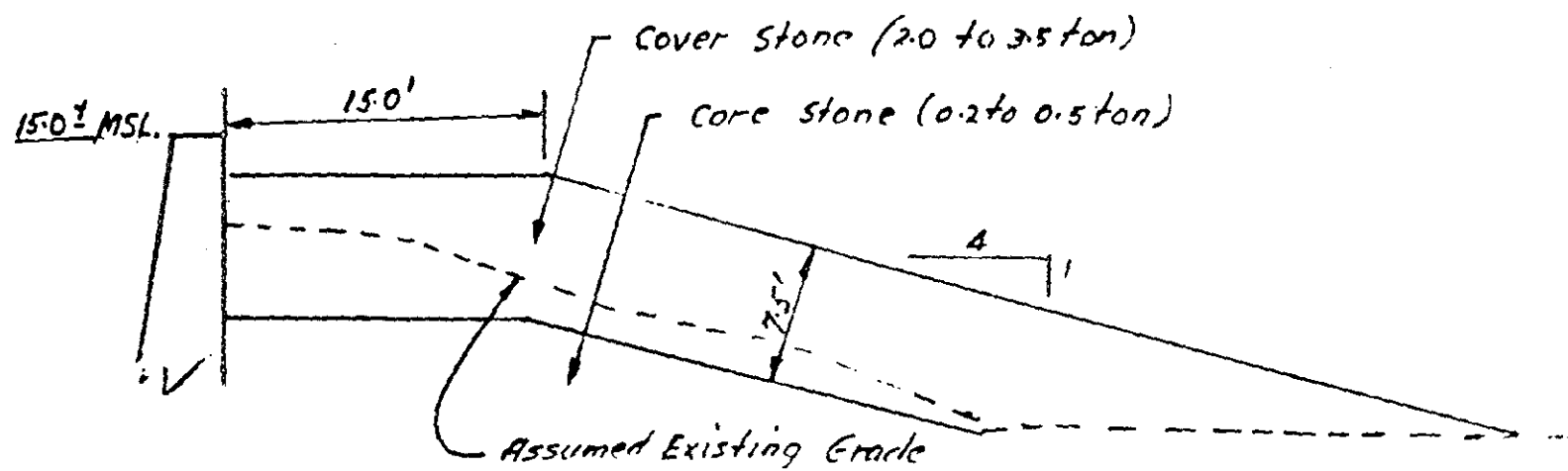
Approximately 20,000 cubic yards of sand would be required, sea grass would be planted on the dunes and a drift fence would be included in the protected area. This plan of protection has an estimated first cost of \$6.5 million and would provide protection against a recurrence of the estimated 100-year flood event. Annual benefits for this area are estimated at \$480,000 while estimated annual costs are about \$478,000, resulting in a benefit-to-cost ratio of 1.0 to 1.0. Sketch plans of the above stone berm and sandfill are shown as Plates 5 and 6 respectively.

E. OAK ISLAND

This area encompasses all of the Pines River backshore tidal area and the major drainage system that discharges runoff from low areas to the east of North Shore Road. Major damage zones here include Oak Island, Mills Avenue (Riverside) and local streets in the vicinity of Diamond Creek. Backshore protection could be provided by either of two alternative methods, namely (Plan 1) a tidal barrier across the mouth of the Saugus-Pines River or (Plan 2) tidal gates and pumping stations at the Diamond Creek outlet and at North Shore Road. Plan 1 would cost over \$20 million and would prevent tidal flooding in all the backshore areas, while Plan 2 has an estimated first cost of \$4 million but would not provide flood protection to low-lying shorefront properties at Riverside.

The less expensive alternative would utilize the existing Boston & Maine Railroad embankment as a tidal dike. A gated outlet pipe and pumping station would be required where the interior drainage ditch flows into Diamond

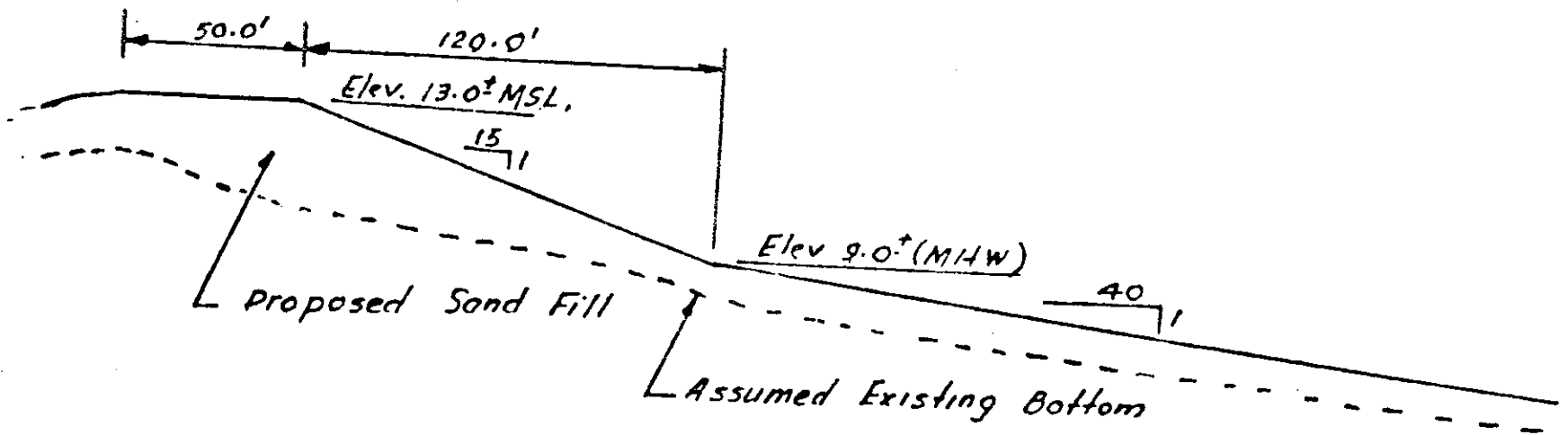
Creek. During flood periods the gates would be closed and the pumping station would discharge interior runoff and drainage from behind the railroad embankment. To protect lowlands near Island Street, 5000 linear feet of North Shore Road would have to be raised about four feet. Here again, tidal gates and a pumping station would prevent flood inflows from the Pines River. Annual benefits are estimated at \$438,000 while annual costs, based on the \$4 million project cost, are estimated at about \$300,000 thereby providing a benefit-to-cost ratio of 1.5 to 1.0. A sketch plan of this alternative is shown as Plate 7.



POINT OF PINES

STONE BERM

REVERE, MASS
Scale 1"=10'

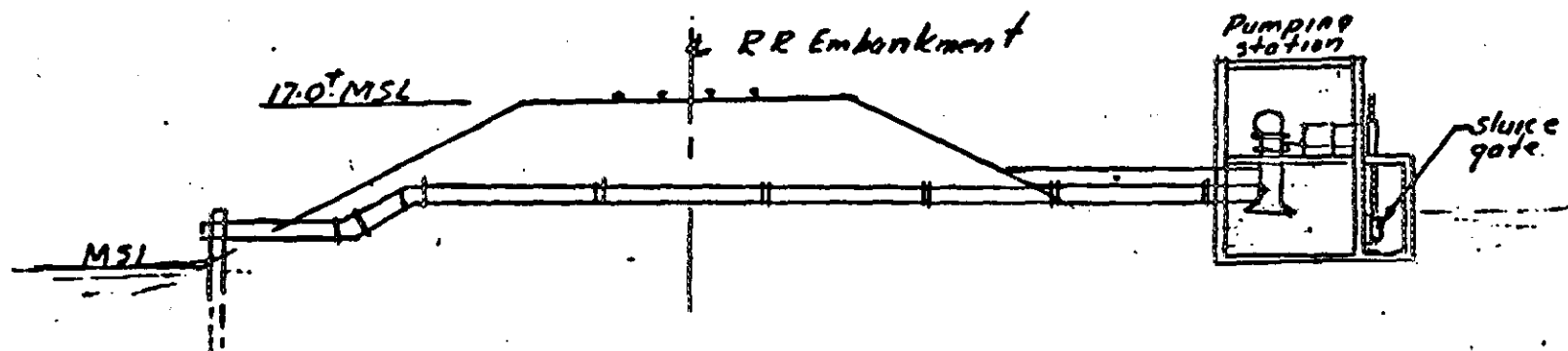


POINT OF PINES

SAND FILL

Horz. Scale 1"=50'

Vert. Scale 1"=10'



OAK ISLAND & VICINITY
 TIDAL GATES & PUMP STATION
 REVERE, MASS.
 Scale 1"=20'

SECTION V

CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This Reconnaissance Report investigated preliminary alternative solutions to coastal flood protection for the Revere shorefront. It was concluded that flood protection is feasible and justified. No significant adverse environmental impacts are expected to result from any of the alternatives studied. Due to the severe flooding and extreme hardships caused by northeast storms, particularly the February 1978 Blizzard, and the losses being suffered on a regular basis, there is sufficient justification to allow continued Federal participation in the planning and potential implementation of coastal flood protection plans--both structural and nonstructural.

During future detailed planning efforts, an Environmental Impact Statement (EIS) will be prepared if necessary, and existing Executive Orders (EO) pertaining to flood plain zoning and wetlands management will be addressed. Preliminary coordination has been maintained with the Metropolitan District Commission (MDC), Coastal Zone Management (CZM), and Division of Waterways offices of the Commonwealth of Massachusetts. Revere city officials have expressed complete support and an intense need for early implementation of flood control improvements.

B. RECOMMENDATIONS

The Division Engineer recommends that study efforts proceed into Stage II as outlined in this reconnaissance report.

SECTION VI

APPENDICES

APPENDIX A

GREAT BLIZZARD NEWSCLIP

A tide of despair runs in Beachmont after waves recede

The sea, in the worst of its moods, destroys.

It roars in one day, leaving destruction in its wake, and disappears just as quickly, lapping gently at the beachfront. It is the child who raids the cookie jar and feigns innocence, despite the crumbs on his face.

But in Beachmont, jutting out like a spur on the Revere shoreline, the damage runs deeper than the destruction, regardless of how devastating.

In Beachmont, human despair runs with the force of an undertow, long after the waves recede, after the sightseers go home, after the disaster crews go elsewhere.

It is a modest, blue-collar neighborhood of a few hundred families who save what extra money they have so that Joey might go to college someday. There are no frills. Nothing salted away for a rainy day. No fat bank account with money to put homes back on their foundations, to replace cars drowned in a furious sea.

The personal losses are great. For most, it is a time to start over. For a few, a time to give up. Some will move away from the sea, into Medford or Saugus. Others will try again, daring nature once more.

Hundreds strong, from all over Revere, they filed into the Federal Disaster Relief Center in the basement of St. Anthony's Church all week long. They came in search of low cost loans, of help with their taxes, of money for clothes and food.

Many carried with them all that they owned.

They stood in line for hours at the Red Cross table, in search of a voucher that would get them new eyeglasses, new dentures or perhaps merely a new walking cane.

They talked with federal representatives from the Department of Housing and Urban Development in search of a place to live, away from the cramped quarters of

relatives and friends or the impersonal air of the Revere High School gymnasium.

Some had heard stories that mobile homes were en route, to be placed at the spot where their homes once stood. They were told that it wasn't so and instead were sent to a room at the nearest Ramada Inn.

By week's end, some of the losses would be replaced. New clothing and new shoes would be bought with money from the Red Cross. No one would replace the memories of a lifetime in the Beachmont neighborhood.

While they stood waiting in the relief center, a Revere city official moved from house to house on the shore side of Broad-sound avenue, tacking up small red signs which read: "Notice. Dangerous Building." It was the equivalent of being condemned, unsafe for human habitation.

When, and if, they returned to Beachmont, it would be a different neighborhood. Some of the old neighbors will have moved. Those who remain will live in fear of the ocean just beyond the seawall, changing the atmosphere of a street that had survived in relative bliss since the Hurricane of '38.

The sea, in the worst of its moods, can tear a neighborhood apart.

In Beachmont, there is a hope that federal money, state aid and city assistance will make the area a neighborhood once more.

It is still too early for dollar estimates, too soon to tell just how many Beachmont homes will be saved, how many will be torn apart and carted off to the dump.

For the dozen or so knocked from their foundations, there is little hope. For the others, only time will tell.

But there is a confidence here that others will replace those that are gone and that Beachmont will once again become a neighborhood, however changed, on the edge of the ocean.

APPENDIX B

FISH AND WILDLIFE RESOURCES

REVERE

FISH AND WILDLIFE RESOURCES

The Revere Beach area (from Roughan's Point to Lynn), and the Saugus and Pines Rivers, have historically been popular areas for harvesting shellfish and finfish. Before arrival of English colonists, Indians visited the area to fish for abundant salmon, trout, alewives and bass. The English colonists quickly recognized the value of the local fishery, establishing commercial fishing for bass, herring and cod.

By the 19th century, commercial fishing in the area expanded to include haddock, mackerel, cunner and eels. By the turn of the century, salmon, shad and bass apparently disappeared.

Fishing in the area in the early 1900's is poorly documented. By 1958 the Lynn Harbor area had developed into a popular sport fishing area, featuring mackerel, cod, bass and groundfish.

Shellfish, particularly clams and mussels, were a source of food for early colonists. The Boston coastal region was the primary source for soft shell clams in the early 20th century, but increasing pollution resulted in harvest restrictions in many areas. By 1926, most of the Lynn-Nahant clam flats were restricted from harvesting. The largest portion of productive shellfish flats in the study area are still closed to harvest for human consumption. Only the waters and tidal flats of the Pines River, including Diamond Creek, lying northwesterly of the Lynnway, remain open to shellfish harvest.

Sampling in Lynn Harbor during 1968 to 1969 found 31 species of finfish. At five shore sampling stations, the six most abundant species were: Atlantic silverside, mummichog, striped killifish, threespine stickleback, Atlantic tomcod, and red hake. At four offshore stations, winter flounder, rainbow smelt, and Atlantic tomcod were the most abundant sport and commercial species taken.

The Pines River contains the major portion of the productive soft shell clam habitat in the Lynn Harbor area, and the only area of legal clam harvesting (with proper purification).

The study area at Roughan's Point includes the Cherry Island Bar, the second largest clam flat in Revere. This flat is presently closed to harvesting because of pollution, but continues to act as a seed source of young clams for other areas. Structural modifications to the existing seawall which involve filling in front of the wall may result in a loss of a portion of this clam production area.

Offshore breakwater structures would require covering an area of probable benthic habitat and associated biota. After construction, the stone breakwater would provide suitable habitat for sessile organisms. Winter flounder, the major groundfish in the area, utilize the study area mostly in the adult stage. The shallower waters of area salt marshes act as nursery grounds. Construction activity would result in short term turbidity but no long term negative impact.

Chesmore, A.P., D.J. Brown and R.D. Anderson. A Study of the Marine Resources of Lynn-Saugus Harbor. Massachusetts Department of Natural Resources, Division of Marine Fisheries, Monograph Series No. 11. 1972

APPENDIX C

CORRESPONDENCE



GEORGE V. COLELLA
MAYOR

THE CITY OF
REVERE, MASSACHUSETTS

OFFICE OF THE MAYOR
CITY HALL

October 23, 1978

Colonel John P. Chandler
Division Engineer
N.E. Division, U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Chandler,

The City of Revere requests that the Army Corps of Engineers undertake a study to investigate flooding conditions and to determine the economic feasibility of constructing a flood control project in the Revere Beach section of the City.

The Revere Beach section, because it is relatively flat with low ground elevations, is subject to flooding from several sources: stormwater runoff from intense rainfall, which the drainage system cannot handle; wave runup over the seawall along Revere Beach Boulevard; and water backup from Diamond Creek, when drainage through the county ditch is prohibited by high tides.

As you may be aware, there are several major public projects proposed for the Revere Beach area. These include the MBTA extension of the Blue Line; station rehabilitation and construction of the 1200 car garage at the Wonderland Station; the DPW Revere Beach Connector, which will cut across the City from the West, providing direct access to the MBTA garage; the MDC revitalization of the Revere Beach Reservation; and the ALBA Corporation Residential Development of 630 units.

At my request, a meeting of the involved state agencies was held on October 18, 1978 to discuss drainage and flooding considerations related to these construction projects. Representatives of the Army Corps of Engineers were also asked to attend the meeting. At that time, Mr. Paul E. Pronovost of the Planning Division mentioned that the Corps can undertake small scale studies to investigate flooding conditions from external sources. He explained that, at the City's request, the Corps could carry out a short-term study of 2-3 months duration (approximately \$5,000) to determine the economic feasibility of a capital flood control program for Revere Beach.

Should the Corps concur with our request, the City would provide assistance in carrying out the project. I have assigned Terrence Geoghegan and Marion Cra-ven of my Joint Development Office as contact people for the flood study. HUD

Colonel John P. Chandler

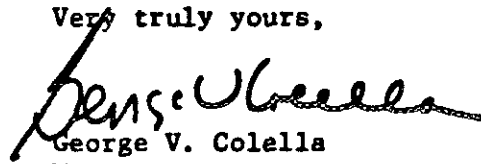
-2-

October 23, 1978

floodplain maps and maps of flooding conditions of the February 1978 Blizzard are available in the City's Office of Community Development.

Thank you for your attention to this request. The City of Revere looks forward to working with the Army Corps of Engineers on this complex problem.

Very truly yours,



George V. Colella
Mayor

GVC/lf

cc: Terrence Geoghegan
Marion Craven
Paul Rupp

The City of Revere Massachusetts



City Hall

281 BROADWAY
REVERE, MA 02151
284-3600

Revere Beach Citizens Advisory Committee

Feb 21, 1979

Col John P Chandler
Division Engineer
Dept of the Army
Corps of Engineers
New England Division
424 Trapelo Road
Waltham Ma 02154

Dear Col Chandler;

The Revere Beach Citizens Advisory Committee (R.B.C.A.C.) is charged with the participation in all aspects of planning for the Revere Beach Development Program. For that reason we have a strong interest in three aspects of this program in which the U S Army Corps of Engineers has direct involvement, i.e. (1) Beach Erosion/Renourishing (2) Flood Control and (3) Impact of the proposed Lynn Water Front Development Program.

Following preliminary discussions of these subjects between a member of this committee and two members of your staff (Donald Martin and William Swaine) we feel it would be mutually productive if you could arrange for appointed members of your organization to meet with the full membership of the R.B.C.A.C. to discuss your current activities and future planning regarding these three critical areas. It is requested that they meet with us Thursday evening March 15, 7:30pm at the Abraham Lincoln School, Tuckerman St (off Broadway), Revere.

Very truly yours,

Chairwoman R.B.C.A.C.



The Commonwealth of Massachusetts

HOUSE OF REPRESENTATIVES
STATE HOUSE, BOSTON 02133

ALFRED E. SAGGESE, JR.
20TH SUFFOLK DISTRICT
95 LORING ROAD
WINTHROP, MA 02152
TEL. 846-9123

Committees on
Bills in Third Reading, Vice ()
Judiciary
Ethics

ROOM 138, STATE HO
TEL. 727-2386

July 30, 1980

Honorable George V. Colella
Mayor of Revere
City Hall
Revere, MA 02151

Dear Mayor Colella:

Recently, a group of our constituents from Beachmont contacted my office in regard to improvements to the Marsh-land and waterways of the Belle Isle area.

The residents of the area adjoining the marsh have chronic and serious problems with flooding, insects, and rats. These pose a health hazard and should, by themselves, initiate some action. Furthermore, Belle Isle Inlet and its adjoining waterways are in need of dredging as the water levels have added to the flooding problems and made the Beachmont Yacht Club virtually inaccessible by boat.

I have been in contact with the Department of Environmental Quality Engineering to investigate the possibility of having Belle Isle dredged in the near future. May I suggest that you, as Mayor of Revere, contact Colonel Max Scheider of the Army Corps of Engineers to initiate a possible program of flood control and waterway clearance for the area.

I am looking forward to hearing from you regarding the problems of this area.

With every good wish, I remain

Sincerely,

Alfred E. Saggesse, Jr.

ALFRED E. SAGGESE, JR.
State Representative

AES:jw

cc Miss Mabel Woodcock
126 Crystal Avenue
Revere, MA 02151

Mr. Robert Foy
135 Crystal Avenue
Revere, MA 02151

Fred Milton
Commodore
Beachmont Yacht Club
Revere, MA 02151



GEORGE V COLELLA
MAYOR

THE CITY OF
REVERE, MASSACHUSETTS
—
OFFICE OF THE MAYOR
CITY HALL

August 6, 1980

Colonel Max Scheider
New England Division
Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Scheider:

Recently, a group of residents from Beachmont contacted me in regard to chronic flooding problems along the Belle Isle Inlet.

As evidenced by the "Reconnaissance Report" for coastal flood protection in Revere, the Corps of Engineers conducted an investigation of flood problems in the Beachmont area.

I would appreciate any recommendations which your staff could provide in regard to the Belle Isle Inlet; perhaps you can justify including this area in the ongoing investigation of Revere's coastal flood problems.

I respectfully express my appreciation to you and your staff for all you hard work in producing the "Reconnaissance Report" of Revere's flood conditions. The City of Revere is looking forward to continued cooperation with the Army Corps of Engineers on this vital problem.

May I anticipate your recommendations on Belle Isle Inlet at your earliest opportunity?

Very truly yours,

George V. Colella
Mayor

GVC/lf

cc: Robert Krinsky, Office of Planning and Community Development
Representative Alfred E. Saggese
Mabel Woodcock
Robert Fox
Fred Milton

**PINES RIVERSIDE
ASSOCIATION
REVERE, MASSACHUSETTS 02151**

April 11, 1981

Army Corp of Engineers
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Sir/Madam:

After carefully reading over the Coastal Flood Protection Study done by the Army Corp of Engineers, our Association would like to suggest that your department include in the final project design a flood erosion prevention section for Mills Avenue of Revere. This particular area suffers from seasonal flooding and constant erosion problem.

Our organization would be in favor of a revetment and wall that would still give area residents access to the beach area. Thank you.

Yours very truly,

Mary C. Duffy

Mary C. Duffy
Corresponding Secretary
157 Mills Avenue
Revere, Massachusetts 02151

APPENDIX D

EXISTING INSTITUTIONS

EXISTING INSTITUTIONS

A. FEDERAL

(1) US Geological Survey, Water Resources Division (USGS). The overall objectives of the US Geological Survey are to conduct surveys, investigations and research covering topography, geology, and the mineral and water resources of the United States. The agency is responsible for coordinating all data collected by Federal agencies having to do with water resources. To facilitate this task, the USGS maintains catalogs and maps of water-related information which is useful as a basis for planning.

(2) US Department of Agriculture, Soil Conservation Service (SCS). The Soil Conservation Service provides technical assistance in the development, application and maintenance of soil and water conservation plans. The agency is authorized to assist local governments with planning and financing watershed conservation projects and other flood prevention measures. These programs provide assistance in projects that promote the conservation, development and use of water and the prevention of soil erosion.

(3) US Environmental Protection Agency (EPA). The Environmental Protection Agency is responsible for the control of air and water pollution, drinking water quality, solid wastes, pesticides, environmental radiation and noise. Through the legislation contained in PL 92-500, the agency establishes deadlines for clean waters, a system of permits and licenses, water quality standards, a system of user charges, and areawide planning. The agency also provides funding and enforcement powers to eliminate the discharge of pollutants into the Nation's waters. Congress has authorized EPA to provide state grants for research and development, manpower training, water quality planning, monitoring and enforcement.

(4) US Department of Housing and Urban Development (HUD). Under the provisions of Section 701 of the National Housing Act of 1954, as amended, this agency is involved with state and local governments in planning and developing solutions to housing problems, mass transportation, water supply, water quality management, runoff control and related problems.

(5) US Army Corps of Engineers, New England Division (CE/NED). The Corps of Engineers involvement with water resources includes navigation improvements, streambank and shore erosion control measures, flood control works, reporting on streams, shores and flood plains and providing flood plain management services. A substantial part of the Corps work is in related areas such as provision for water supply, hydroelectric power generation, stream regulation, and water-based recreation. Recent duties include the administration of laws to preserve important wetlands and navigable waters and their environmental quality. In keeping with the need to enhance the environment's quality and productivity, the Corps has also been charged with developing comprehensive plans for the conservation and efficient use of vital water and related land resources.

(6) Federal Emergency Management Agency, Federal Insurance Administration (FEMA/FIA). The National Flood Insurance Program is under the direction of FEMA—formerly the Department of Housing and Urban Development, Flood Insurance Administration. The program provides local officials with a usable tool in protection of their flood plains once on the regular program. A flood-prone community must enact flood plain zoning in accordance with minimum guidelines established by FEMA. Failure to enact or enforce such legislation could be penalized by forfeiture of all Federal funding assistance.

A product of the program is the Flood Insurance Study (FIS). These studies include compilation of stream profiles, delineation of flood plains, and flood hazard analyses.

(7) US Department of the Interior, Fish and Wildlife Service. The primary goal of this agency is the conservation and enhancement of fish and wildlife resources. Major activities for the conservation of fish and wildlife include the acquisition and management of national wildlife refuges, and the operation of fish breeding, distribution and restoration programs. Other activities include the protection of critical habitats, the enforcement of Federal law protecting wildlife and management of game birds, and consultation with other Federal agencies engaged in water development projects.

B. INTERSTATE

The New England Governors' Conference, which is composed of the six New England governors, exists to coordinate state activities with regard to natural resources. A Federal Regional Council has also been established for the New England region. This council is to improve the administration of Federal grant programs in the region by improving program operations, developing funding programs in cooperation with state and local officials, and encouraging joint and complementary grant applications. Finally, other special-purpose organizations such as the New England Interstate Water Pollution Control Commission exist to coordinate specific functional activities in the region.

C. COMMONWEALTH OF MASSACHUSETTS

The Executive Office of Environmental Affairs (EOEA) includes and provides for the following: the management of air, water and land resources to assure their protection and balanced utilization; the propagation, protection and management of fish and wildlife; and the regulation and protection of marine and coastal fisheries and natural resources. Some of the major agencies concerned with water resources within the EOEA include:

(i) The Department of Environmental Quality Engineering (DEQE). DEQE has responsibilities which include the management of Section 208 planning; administration of the wetlands regulatory program; approval of new water supplies; planning and construction of small and medium river and stream improvement projects; and the licensing and inspection of dams.

- . **Division of Waterway** - The duties of this office include the protection of shorelines of the state and the provision of safe, functional and convenient public access to the public waters of the Commonwealth. The maintenance of the seawall at Roughan's Point is the responsibility of the Division.

- . **Water Resource Commission** - This arm of DEQE is responsible for the management and coordination of all planning activities at the state and regional levels and the development of comprehensive plans for growth and development.

(2) The Department of Environmental Management (DEM). The Division of Water Resources within DEM is responsible for coordinating all water resources activities as they affect the Commonwealth. In this regard, the Division is charged with the coordination of all water and related land resources activities of Federal, state, regional and interstate agencies.

(3) The Metropolitan District Commission (MDC). The Metropolitan Sewerage District, established in the Commonwealth in 1889, was the first legally constituted metropolitan district in the United States and originally served 18 cities and towns. In 1901, the Metropolitan Sewerage Commission and the Metropolitan Water Board (established in 1895) were abolished and the powers and duties were transferred to the Metropolitan Water and Sewerage Board. In 1919 the Metropolitan District Commission was created to assume the powers, duties and responsibilities of the Metropolitan Parks Commission and the Metropolitan Water and Sewerage Board. With the creation of the Executive Office of Environmental Affairs in 1974, the MDC became a department within this cabinet level executive office. The MDC provides water, sewerage, and park and recreation services to its 54 member cities and towns within the Boston metropolitan area, including Revere.

- . **Sewerage** - The MDC wholesales sewerage treatment services to its members; however, the responsibility for construction, operation and maintenance of local systems rests with each community.

- . **Water** - New England's largest supplier of water is the MDC. Three major reservoirs - Quabbin, Wachusett, and Sudbury - impound water diverted from tributaries of the Connecticut and Merrimack River basins, meeting the needs of the MDC service area.

- . **Parks** - In addition, the MDC is charged with responsibility over parks and other recreational facilities, such as the Revere Beach Reservation, within its jurisdiction. This includes operation and maintenance of the pumping stations at Roughan's Point and Point of Pines, and the existing protection along Revere Beach.

- . **Police** - The MDC maintains the third largest police force in New England to provide the needed security to its parks and other facilities.

(4) Coastal Zone Management (CZM). CZM has developed a management program which offers technical assistance to communities, provides for Federal consistency with CZM policies, and above all, sets a high priority on placing the

state's regulatory and management programs in order and making them work in a more assured, timely and consistent manner. Under CZM, the Commonwealth will assess the impact of proposed activities in the coastal zone, encourage those activities that are consistent with coastal zone policies, and discourage or prohibit those that are inconsistent.

D. REGIONAL.

The Metropolitan Area Planning Council (MAPC) is greater Boston's officially designated regional planning agency. Its membership consists of 101 cities and towns (including Revere), 11 state agencies, and 21 gubernatorial appointees. The Council is the representative agency for the local governments within the metropolitan area for intergovernmental cooperation and comprehensive planning.